7 RECOMMENDED PLAN

7.1 OVERVIEW OF RECOMMENDED PLAN

The Recommended Plan for the study area constitutes three phases:

- Immediate Improvements: Structural rehabilitation of QEW bridges at three locations that have reached their rehabilitation milestones
- Interim Improvements: Addition of one High Occupancy Vehicle (HOV) lane on the QEW and addition of one General Purpose Lane (GPL) on Highway 403, in each direction
- Ultimate Improvements: Addition of one GPL on the QEW, in each direction

The QEW and Highway 403 widening improvements in both the interim and ultimate improvement phases are illustrated in the typical sections included in **Exhibits 7-1 and 7-2**. These improvements will require structural improvements, including bridge widening and / or replacement, as well as interchange ramp improvements. As described in **Section 3**, the primary purpose of this study is to identify and plan for the immediate structural rehabilitation needs of structures in the study area, and ensure that any work conducted is compatible with a longer-term plan.

For the purposes of this Class EA and the associated traffic analysis, a project horizon year of 2041 was assumed. Immediate improvements, including structural rehabilitation work, is anticipated to occur in approximately 2023. Timelines for implementation of the recommended interim and ultimate improvements are subject to provincial funding and priorities.

The ultimate improvements (Technically Preferred Alternative) are detailed in the preliminary design plates included in **Appendix A**. The interim improvements are detailed in the preliminary design plates included in **Appendix M.**

7.1.1 IMMEDIATE IMPROVEMENTS

Structures at three QEW crossing locations will require rehabilitation in the near future, and this work is included in MTO's current 5-year capital plan.

- Brant Street Interchange East- and Westbound Overpass Structures
- QEW and CN Rail Crossing (north of Fairview Street) Overhead Structures
- Highway 403 eastbound to Fairview Street Off-Ramp CN Rail Overhead Structure
- Plains Road East / Fairview Street Interchange North- and Southbound Overpasses

To minimize disruptions to the QEW, it is necessary to widen the structures to accommodate traffic during rehabilitation work. At the Brant Street Interchange, both overpasses will be widened into the existing median. At the Plains Road East / Fairview Street Interchange and at the QEW and CN Rail Overhead, the Niagara-bound (southbound) structures will be widened into the median.

The bridge rehabilitation work will include the following: replacement of barrier walls; replacement of abutment bearings; replacement of expansion joints or conversion to semi-integral abutments; concrete patch work and repairs; replacement of waterproofing and paving; and bridge widening.

7.1.2 INTERIM AND ULTIMATE IMPROVEMENTS

In the Interim Improvements phase, the QEW will be widened to accommodate one new HOV lane in each direction. In most areas, widening will be constructed within the existing median; however, in the area of the Plains Road East and Fairview Street interchange, some of the widening will occur to the east of the existing QEW in order to minimize impacts to an existing watercourse. Highway 403 will also be widened into the median to accommodate one new general-purpose lane in each direction. Other improvements to ramps and roads will also be completed during this stage and these are summarized in **Table 7-1.**

In the Ultimate Improvements phase, the QEW will be widened to accommodate one new general-purpose lane in each direction between the Burlington Skyway and the Guelph Line interchange; these new lanes will be constructed to build upon the QEW improvements already completed in the interim phase. Thus, the ultimate QEW will have a 'basic' cross-section of ten lanes (HOV and four lanes in each direction) compared to the existing six lanes (three lanes in each direction). However, the actual number of lanes in each direction will vary throughout the study area due to the Freeman Interchange ramps, and the auxiliary lanes of the arterial interchanges.

As mentioned above, a shift to the east of the QEW centreline is proposed between the North Shore Boulevard interchange and the Freeman Interchange (QEW South Leg) to help avoid impacts to an existing watercourse to the west of the existing QEW. The centreline shift will be to the east of the existing centreline to a maximum distance of approximately 5 m through the Plains Road East / Fairview Street Interchange. The proposed centreline returns to the existing centreline through the North Shore Boulevard interchange and Freeman interchange. The existing centreline is retained on the QEW between Brant Street and Guelph Line (QEW East Leg) and on Highway 403. The QEW centreline shift will initially occur during the construction of the interim improvements.

Several interchange ramp improvements and crossing road improvements are also proposed within the study area, either to accommodate highway widening or to improve interchange traffic operations.

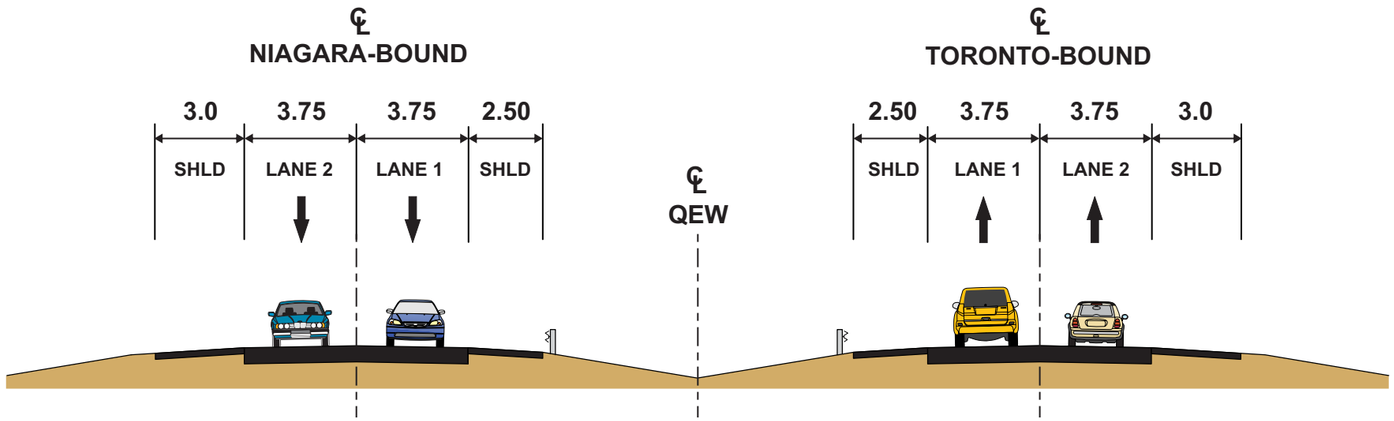
Table 7-1 summarizes the key features of the improvements per location and phase. If a location is noted as not applicable (“N/A”) in the ultimate improvement phase, it means the improvements completed in the interim will be sufficient to accommodate the operational and/or infrastructure needs to the project horizon year.

In addition to the key features, there will be improvements to infrastructure elements including speed-change lane lengths and shoulder widths throughout the study area, and several structural widenings and/or replacements required due to the ramp and mainline improvements.

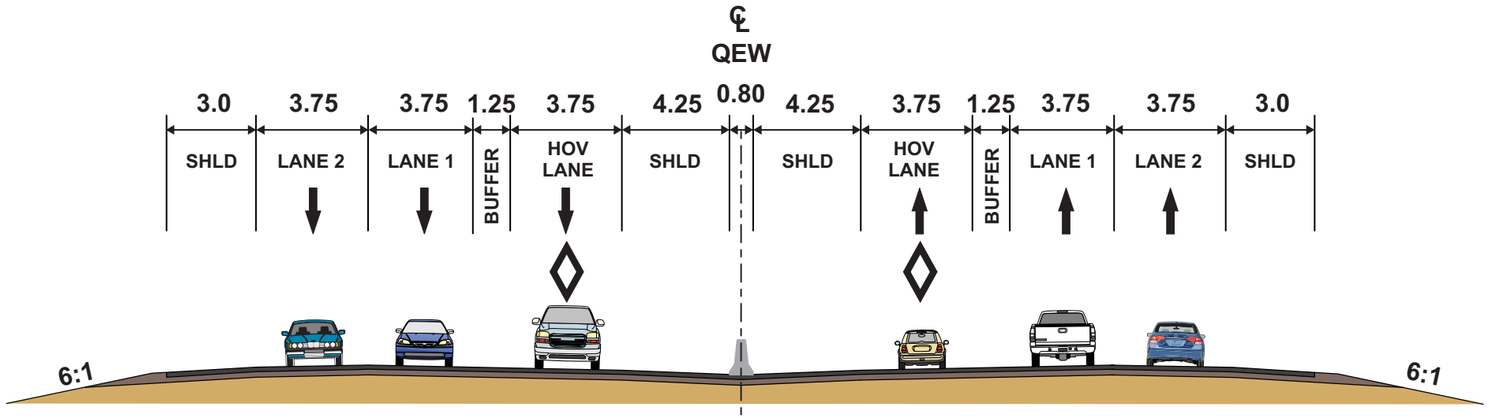
WEST

EAST

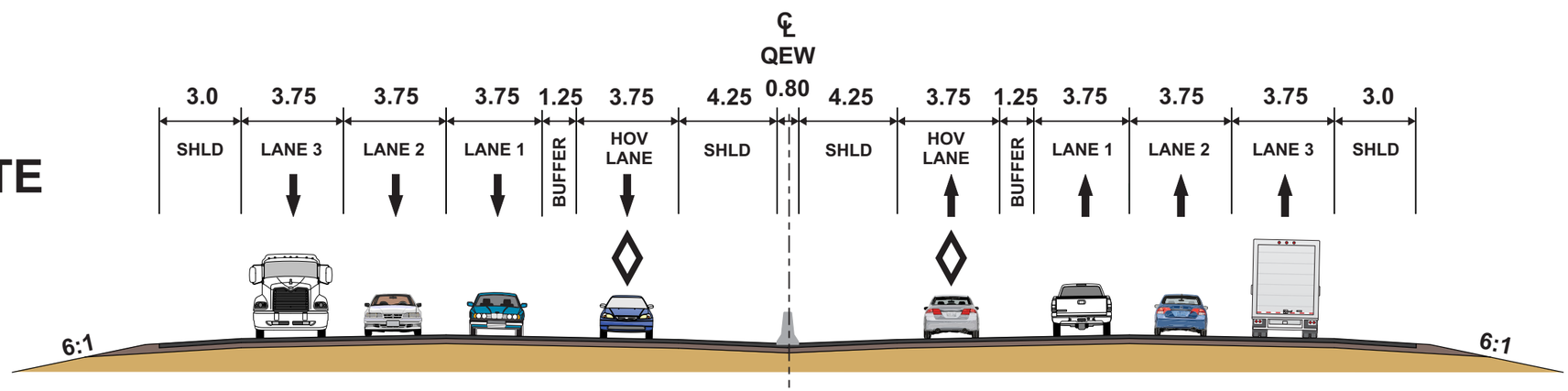
EXISTING



INTERIM



ULTIMATE



QEW through Freeman Interchange used as example. Exact shoulder widths may vary.

Ontario

wsp

QEW AND HIGHWAY 403 (FREEMAN) INTERCHANGE
TRANSPORTATION ENVIRONMENTAL STUDY REPORT
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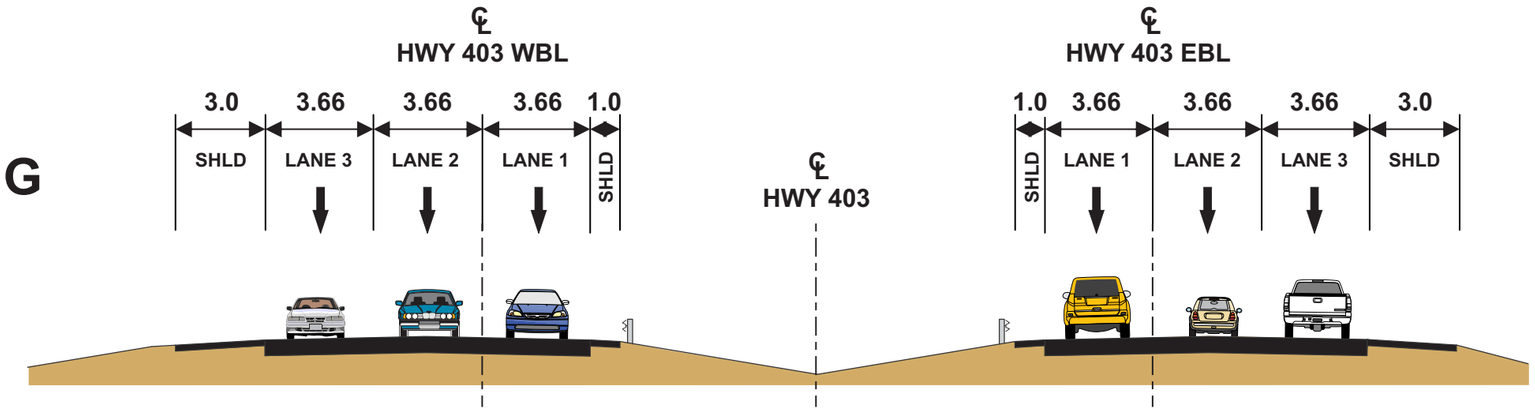
Exhibit 7-1
QEW Typical Sections

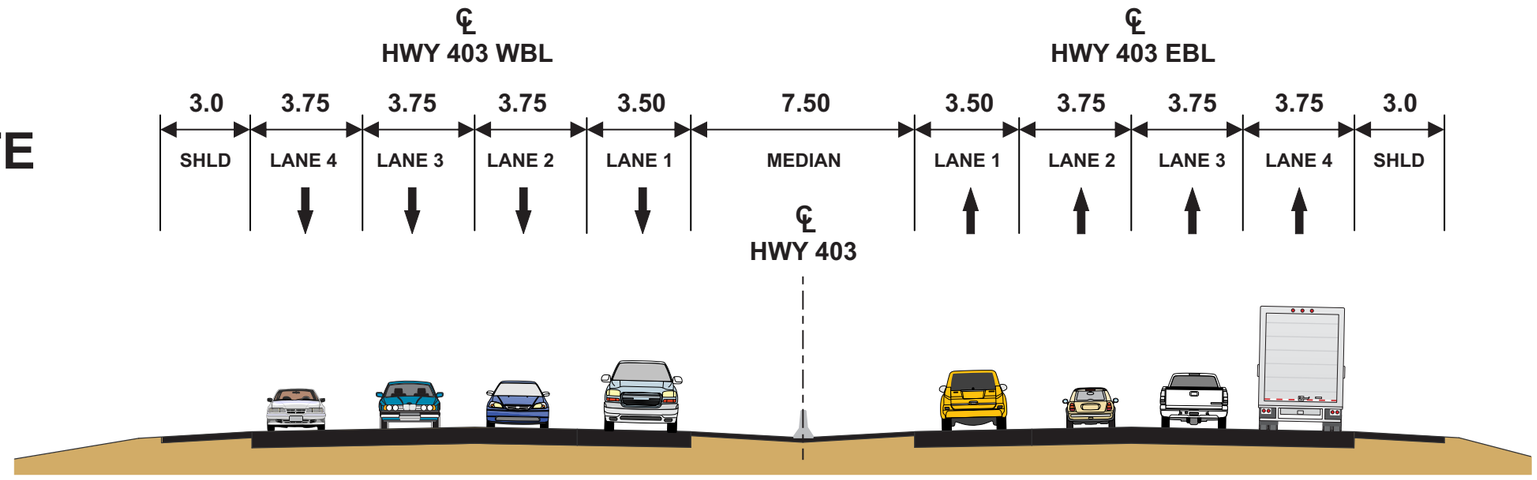
NORTH

SOUTH

EXISTING



INTERIM / ULTIMATE



Ontario

wsp

QEW AND HIGHWAY 403 (FREEMAN) INTERCHANGE
TRANSPORTATION ENVIRONMENTAL STUDY REPORT
MTO Project # 2016-E-0005

Exhibit 7-1A
Highway 403 Typical Sections

Table 7-1: Summary of Interim/Ultimate Improvements within the Study Area

Location	Interim Improvements	Ultimate Improvements
QEW Mainline	Widen into median and accommodate additional HOV Lane per direction to accommodate traffic growth.	Widen to outside and accommodate additional general-purpose lane per direction to accommodate traffic growth.
Highway 403 Mainline	Widen into median and accommodate additional general-purpose lane per direction.	N/A
Guelph Line Interchange	Alignment improvements to Toronto-bound exit ramp, to accommodate wider QEW and enhance operations and safety.	N/A
North Service Road, between Brant Street and Guelph Line.	Realign road northerly to accommodate wider QEW.	N/A
QEW and CN Rail Crossing, between Brant Street and Guelph Line	Widen and rehabilitate CN Rail overhead structures to accommodate wider QEW.	N/A
Brant Street Interchange	Widening of overpasses into median to accommodate wider QEW. Alignment improvements to exit ramps in both directions to enhance operations and safety.	Realignment of inner-loop ramps, with new structures, to accommodate further widening of QEW.
Freeman Interchange, Highway 403 Toronto-bound (eastbound) to QEW Toronto-bound (eastbound) Ramp	Replacement of existing two-lane ramp with new three-lane ramp, immediately south of existing, to accommodate traffic growth.	N/A
Freeman Interchange, Highway 403 Toronto-bound (eastbound) to QEW Niagara-bound (southbound) Ramp	(Improvements not required)	Widen to two lanes to accommodate traffic growth.
Freeman Interchange, QEW Toronto-bound (northbound) to Highway 403 Hamilton-bound (westbound) / 407 ETR northbound Ramp	Realign ramp to thread-through 407 ETR structures, shift merge with Highway 403 westerly, enabling three lanes from QEW to Highway 403 to mitigate weaving issues on Niagara-bound QEW near Brant Street.	Widen realigned QEW northbound to Highway 403 westbound ramp to two lanes and construct new two-lane QEW northbound to 407 ETR northbound ramp, to accommodate future traffic growth.
Freeman Interchange, QEW Niagara-bound (westbound) to Highway 403 Hamilton-bound (westbound) Ramp	On the westbound QEW at Brant Street, provide lane balance via an ‘either-or’ lane, enabling a split of three lanes to Highway 403 westbound (Hamilton) and two lanes to QEW southbound (Niagara), to mitigate weaving issues on QEW.	N/A
Plains Road East / Fairview Street Interchange	Easterly shift of the eastern ramp terminal, with realigned ramps, to accommodate easterly shift and widening of QEW.	Widen QEW, including structural widening, to accommodate Freeman Interchange ramp improvements, north of interchange.
King Road Underpass	Replacement of existing structure on current alignment.	N/A

7.1.3 NORTH SHORE BOULEVARD INTERCHANGE IMPROVEMENTS

As mentioned in **Section 1.4,** the North Shore Boulevard Interchange is currently undergoing rehabilitation and will have its overpass structures replaced. To accommodate traffic staging for the overpass replacements, the QEW platform at the interchange will have to be widened under this contract. Therefore, in the future when the Interim Improvements (addition of one HOV lane in each direction on QEW) are constructed, the improvements can tie into the already-widened platform at the interchange.

In the ultimate improvements, when an additional general-purpose lane is provided on the QEW in addition to the HOV lane constructed in the interim, the cross-section will be narrowed so that it can fit on the same QEW platform. The QEW through the North Shore Boulevard Interchange is constrained by the collector ramps and structures either side, and to provide a widened QEW to desirable cross-section widths would result in an overall expansion of the interchange, resulting in environmental impacts to Indian Creek and property displacement.

7.2 NEW CARPOOL LOT

As described in **Section 4.4.2**, a location in the northeast quadrant of the Plains Road East / Fairview Street interchange was previously identified as a potential carpool lot location by the MTO Central Region Carpool Lots Opportunity Study (2007). The study identified this location as it was MTO-owned land, adjacent to the QEW, that was strategically located between Burlington and Hamilton, allowing it to capture a large commuter market in the Toronto-bound (eastbound) direction.

The Recommended Plan includes a new carpool lot at the Plains Road East / Fairview Street location identified by the 2007 study. The proposed improvements at the Plains Road East / Fairview Street interchange require an easterly shift of the east ramp terminal, which in turn requires a realignment of Plains Road East. This realignment encroaches into the land identified for the carpool lot, however does not preclude it. Thus, while the previous study identified a potential capacity of approximately 150 spaces, the available area remaining after the realignment of Plains Road East could accommodate a lot of approximately 80 spaces. A typical carpool lot design is detailed in the Recommended Plan plates (Plate 5) included in **Appendix M.**

7.3 ACTIVE TRANSPORTATION

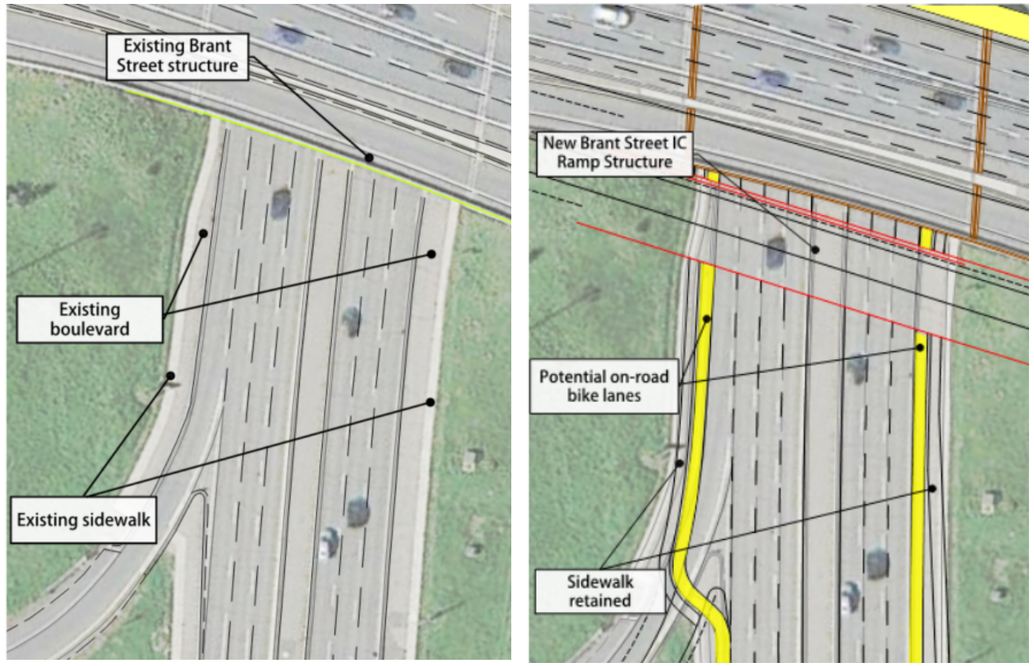
The existing active transportation facilities within the study area are detailed in **Section 4.4.3**. All existing facilities are anticipated to be retained and are not impacted by the proposed improvements. Temporary impacts to and/or temporary closures of active transportation facilities will occur during construction.

The City of Burlington Draft Cycling Plan (August 2019) has identified two potential grade-separated active transportation crossings of the QEW, east of Brant Street and south of Plains Road East / Fairview Street. Although the City has not yet finalized the specific location of these proposed crossings or commenced design, these crossings will not be precluded by the Recommended Plan. MTO will work with the City as these plans are advanced to ensure the crossings will accommodate the recommended QEW mainline improvements.

This study has also identified the feasibility of on-street bike lanes on Brant Street, through the interchange. The interchange is configured in a Parclo A4 configuration, which includes inner-loop ramps in the northeast and southwest quadrants. The generation of the speed-change lanes to these ramps on Brant Street increases the cross-section to its maximum width under the westbound (QEW Niagara-bound) overpass for the northbound lanes and under the eastbound (QEW Toronto-bound) overpass for the southbound lanes. While the existing overpasses are being widened as part of these improvements, their existing spans over Brant Street are being retained and this limits the cross-section width available under the structures. If lane width reduction occurs, a 1.7 m wide on-road bike lane is feasible and this design approach follows MTO's Design and Standards Office, Guidelines for Geometric Design of Cycling Facilities within Constrained Right-of-Ways policy. The potential on-road bike lanes at the interchange are illustrated in **Exhibit 7-3**, focusing on the location south of the overpasses as an example.

As part of the North Shore Boulevard Overpass Replacement contract, mentioned in **Section 1.4**, the North Shore Boulevard roadway through the interchange will also be improved and will accommodate a 1.5 m bike lane in each direction.

Exhibit 7-3: Potential Active Transportation Facilities through Brant Street Interchange



7.4 NOISE WALLS

As described in **Section 4.2.5,** a noise impact assessment was conducted for the Recommended Plan. While no new noise walls are warranted as part of the Recommended Plan, the existing noise wall located on the west side of the QEW, north of the North Shore Boulevard Interchange, will be impacted by the QEW improvements. No other existing noise walls will be impacted. Further details on the noise assessment is detailed in **Section 8.2.2.**

North of North Shore Blvd., a length of existing noise wall (approximately 300 m) is currently located just outside the barrier of the QEW Niagara-bound lanes. In the ultimate condition, a widening occurs at this location that will increase the footprint of the roadway by approximately 4 m and thus the barrier will need to similarly be shifted.

7.5 PROPOSED DRAINAGE AND STORMWATER MANAGEMENT PLAN

A Drainage and Stormwater Management Plan was prepared for the Recommended Plan and is included in **Appendix F.** The existing stormwater and drainage conditions are detailed in **Section 4.4.10.** The conclusion of the analysis and recommendations are summarized below and are detailed in **Exhibit 7-4.**

- An inventory of existing watercourse/drainage crossings within the study areas was completed through a desktop review of available design, contract and as-built drawings, survey information and field investigation.
- There are forty-one (41) watercourse/drainage crossings within the study limits including fifteen (15) within the QEW and Highway 403 (Freeman) Interchange. These crossings discharge into six (6) major watercourses, which include: Grindstone Creek, Falcon Creek, Indian Creek West, East and Main Branches, Hager Creek, Rambo Creek and Roseland Creek. All creeks are regulated by Conservation Halton (CH).
- CH and the City of Burlington are currently updating the Grindstone Creek, Falcon Creek and the Indian/Hager/Rambo/Roseland Creek system hydrologic and hydraulic models. As these models are not available for this study, existing hydrologic conditions were modelled based on previously approved models and other available information provided by CH, City of Burlington and MTO to complete a watercourse/drainage crossing assessment and impact assessments at each outlet downstream of the right-of way. At the commencement of Detailed Design, if an updated hydrologic model is available from CH and City of Burlington, the hydrologic and hydraulic modeling will be reviewed and the recommended plan will be updated, if required.
- A hydraulic assessment was completed for the watercourse/drainage crossings to identify deficiencies and the requirement for rehabilitation/replacement or extension. As a summary, ten (10) culverts are recommended for replacement, six (6) culverts are recommended for extension, two (2) culverts are recommended for rehabilitation and two (2) crossings require clean-out.
- One new culvert is recommended to be installed with the proposed new Stormwater Management (SWM) Pond (detailed later in this section).
- A hydraulic impact assessment was completed for all existing watercourse/drainage crossings to further assess the impact upstream of the proposed culvert extensions and highway expansion. The assessment indicated that the increase in headwater elevations will occur only at nine locations and the increases are generally insignificant (5 cm or less). The only location where the increase in water level is greater than 10 cm will occur within the Freeman interchange and will not impact private property. For the remaining crossings with the slight increase in headwater

elevation, the increases are also confined within the MTO right-of-way and will not impact private property.

- A hydrologic impact assessment was completed at each outlet/hydrologic reference point (HRP) to quantify the increase in peak flows to the receiving drainage systems due to the proposed highway improvements. The assessment indicated that the percentage increase in peak flows are not significant and range from 0 to just over 4 percent; No quantity control is being proposed in outlets discharging to Grindstone Creek and Falcon Creek. Quantity control is being proposed in outlets discharging directly or indirectly to municipal sewer. Quantity control will be provided by a new Freeman interchange SWM (Dry) Pond and six (6) linear detention facilities.
- While retaining walls have been proposed to minimize impacts to adjacent properties, the construction of the new Highway 403 Toronto-bound to QEW Toronto-bound ramp could result in minor encroachment of the existing Freeman Pond, resulting in reduced storage and contributing to the increase in peak out flows at HRP8. The proposed new Freeman interchange SWM (Dry) Pond will also mitigate this impact in addition to mitigating the increase in peak outflows at HRPs 12 and 13.
- A stormwater management (SWM) strategy was developed for the study area based on the result of the hydrologic impact assessment completed at each drainage outlet, identified potential upstream/downstream impacts. The SWM strategy also considered the environmental sensitivity of the recipient drainage system, and maintenance. The proposed SWM strategy consists of grassed swales, enhanced ditches, a new Freeman interchange SWM (Dry) Pond and six (6) linear detention areas. The proposed SWM Strategy is incorporated in the proposed roadway drainage plan presented in **Exhibits 7-4**.
- A high-level review of the roadway surface drainage system was completed to determine the best approach in servicing the re-configured highway. As a summary, the proposed roadway surface drainage would include maintaining the existing ditches that will not be impacted by the proposed highway widening and maintaining the existing median storm sewer that are: in good condition; satisfy MTO's gravity design requirement; and, are not severely impacted by the highway re-configuration. New median storm sewers are proposed to outlet to ditches/grassed swales at least 40 m upstream of receiving watercourse for water quality treatment. To ensure that the existing sewers that are retained have enough conveyance capacity under the proposed highway ultimate condition and satisfy current MTO criteria, a detailed storm sewer and highway sag assessment will be carried out in Detail Design, taking into consideration climate change impact.
- A comprehensive erosion and sediment control (ESC) plan will be developed during the Detail Design phase, and in concert with other design disciplines, such as highway and bridge engineering, fluvial, and aquatic biologists to identify staging requirements, the extent and duration of in-stream works, flow conditions, and the applicable fisheries timing constraints.

As above, Conservation Halton and the City of Burlington are currently updating their drainage models and if these are available during the Detail Design phase, the hydrologic and hydraulic modeling will be refined, and the recommended plan will be updated if needed. With the City's ongoing Mobility Hub and Prosperity Corridor Studies (as described in **Section 3**), there is high potential for development in and around the study area, and significant land use changes could occur prior to the construction of highway improvements. Therefore, the drainage and stormwater management recommendations of this study will also need to be reviewed in this context during subsequent design phases and closer to the time of construction.

GRINDSTONE CREEK TRIB.

GRINDSTONE CREEK TRIB.

GRINDSTONE CREEK TRIB.

WATERDOWN RD N.

WATERDOWN RD

GRINDSTONE CREEK TRIB.

G1
54.78HA

G2
81.45HA

G3
38.80HA

G4
175.15HA

G5
56.12HA

G4-HWY
2.57HA

EX. CULVERT
TO BE
REMAINED

ROADWAY PROFILE
LOW POINT

SPILL
(REG.)

PANIN RD

NORTH SERVICE RD

MATCH LINE
13+500

STUDY LIMIT
12+500

HWY 403

HWY 403

LDA-3

HRP 1

HRP 2

HRP 3

HRP 4

ROADWAY PROFILE
LOW POINT

C.N.R

HOWARD RD

CN RAIL

G1-HWY
1.84HA

G2-HWY
1.55HA

G3-HWY
4.48HA

UPPER GRINDSTONE CREEK

LOWER GRINDSTONE CREEK

LEGEND

DRAINAGE/STORMWATER

- MAJOR/OVERLAND FLOW DIRECTION
- CULVERT FLOW DIRECTION
- MINOR FLOW DIRECTION
- HRP 3 — HYDROLOGIC REFERENCE POINT
- PROPOSED SWM FACLITY
- ENHANCED/GRASSED SWALE

WATER CROSSING

- PROPOSED (NEW) CROSSING
- EXISTING CROSSING TO REMAIN
- EXISTING CROSSING TO BE EXTENDED
- EXISTING CROSSING TO BE REPLACED
- REMOVE/ABANDON EXISTING CROSSING
- EXISTING CULVERT

STORM SEWER

- PROPOSED NEW STORM SEWER
- STORM SEWER TO REMAIN
- MODIFY EXISTING STORM SEWER TO MATCH NEW ALIGNMENT
- REPLACE EXISTING STORM SEWER WITH NEW CATCH BASIN OR STORM SEWER
- REMOVE/ABANDON EXISTING STORM SEWER

GENERAL

- PROPERTY LINE
- CATCHMENT BOUNDARY LINE
- REGULATORY FLOODLINE
- G13 — CROSSING ID
- G13 4.5HA — CATCHMENT ID / CATCHMENT AREA

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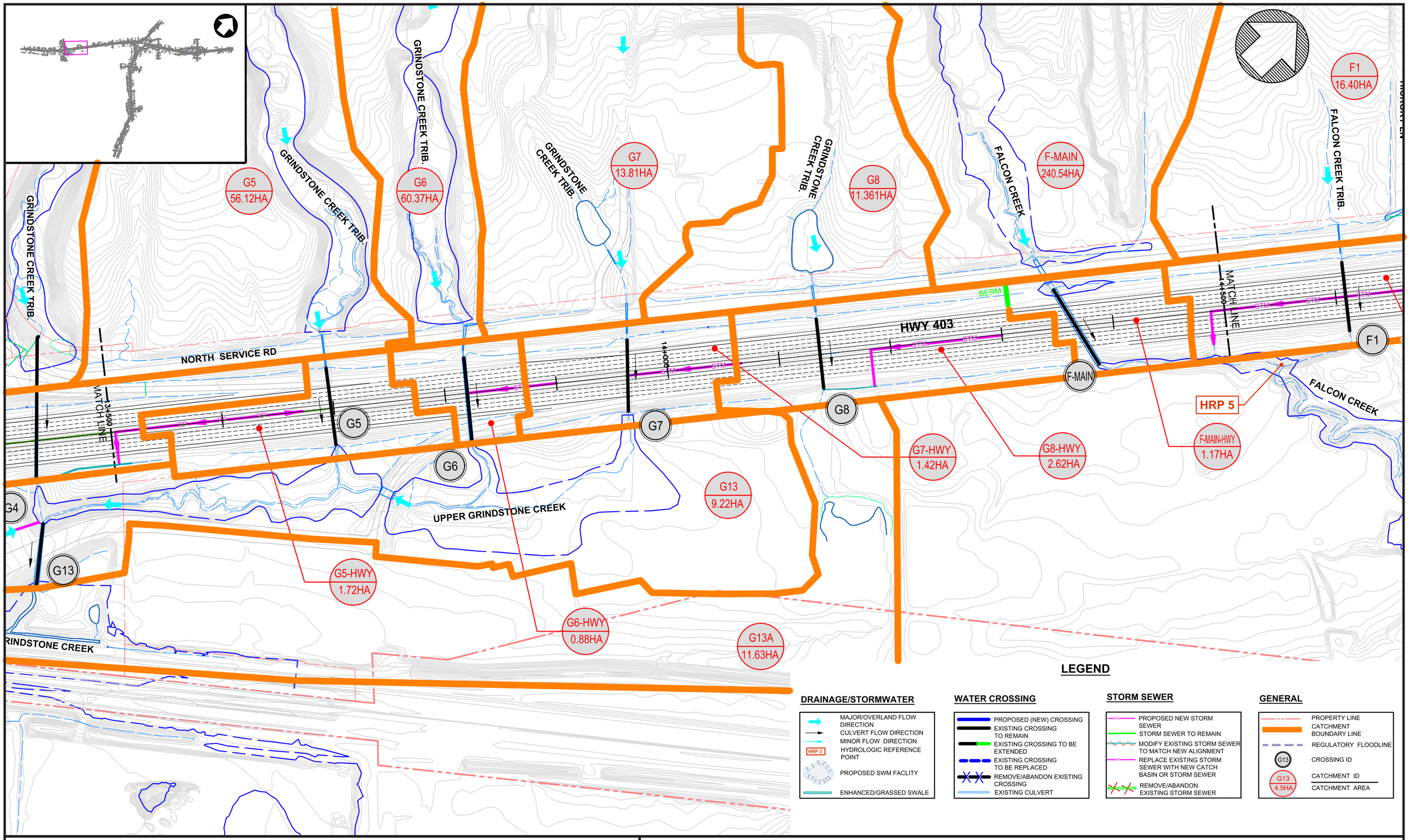
QEW AND HIGHWAY 403 (FREEMAN) INTERCHANGE
TRANSPORTATION ENVIRONMENTAL STUDY REPORT
MTO Project # 2016-E-0005

Exhibit 7-4A
Drainage and Stormwater Management Plan



LEGEND

DRAINAGE/STORMWATER

- MAJOR/OVERLAND FLOW DIRECTION
- CULVERT FLOW DIRECTION
- MINOR FLOW DIRECTION
- HRP 3 — HYDROLOGIC REFERENCE POINT
- PROPOSED SWM FACLITY
- ENHANCED/GRASSED SWALE

WATER CROSSING

- PROPOSED (NEW) CROSSING
- EXISTING CROSSING TO REMAIN
- EXISTING CROSSING TO BE EXTENDED
- EXISTING CROSSING TO BE REPLACED
- REMOVE/ABANDON EXISTING CROSSING
- EXISTING CULVERT

STORM SEWER

- STM — PROPOSED NEW STORM SEWER
- STORM SEWER TO REMAIN
- MODIFY EXISTING STORM SEWER TO MATCH NEW ALIGNMENT
- SD — REPLACE EXISTING STORM SEWER WITH NEW CATCH BASIN OR STORM SEWER
- REMOVE/ABANDON EXISTING STORM SEWER

GENERAL

- PROPERTY LINE
- CATCHMENT BOUNDARY LINE
- REGULATORY FLOODLINE
- G13 — CROSSING ID
- G13 4.5HA — CATCHMENT ID / CATCHMENT AREA

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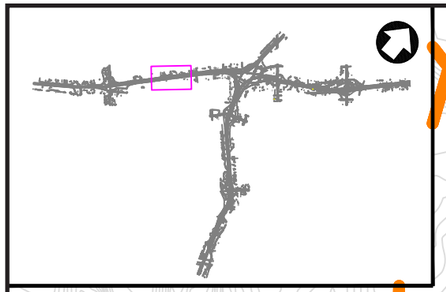
QEW AND HIGHWAY 403 (FREEMAN) INTERCHANGE
TRANSPORTATION ENVIRONMENTAL STUDY REPORT
MTO Project # 2016-E-0005

Exhibit 7-4B
Drainage and Stormwater Management Plan



F1
16.40HA

F-MAIN
240.54HA

I-4A
91.70HA

I-3B
105.90HA

I-4B
29.80HA

YORKTON CT

FALCON CREEK TRIB.

HICKORY LN

NORTH SERVICE RD

NORTH SERVICE RD

ROADWAY PROFILE HIGH POINT

HWY 403

15+000

MATCH LINE 14+500

MATCH LINE 15+500

STM

IW1

IW2

LDA-6

HRP 6

INDIAN CREEK WEST BRANCH

IW3
2.50HA

IW2
1.10HA

IW1
3.60HA

F1

F-MAIN

HRP 5

FALCON CREEK

F1-HWY
4.04HA

F-MAIN-HWY
1.17HA

G8-HWY
2.62HA

LEGEND

DRAINAGE/STORMWATER

- MAJOR/OVERLAND FLOW DIRECTION
- CULVERT FLOW DIRECTION
- MINOR FLOW DIRECTION
- HRP 3 HYDROLOGIC REFERENCE POINT
- PROPOSED SWM FACLITY
- ENHANCED/GRASSED SWALE

WATER CROSSING

- PROPOSED (NEW) CROSSING
- EXISTING CROSSING TO REMAIN
- EXISTING CROSSING TO BE EXTENDED
- EXISTING CROSSING TO BE REPLACED
- REMOVE/ABANDON EXISTING CROSSING
- EXISTING CULVERT

STORM SEWER

- STM PROPOSED NEW STORM SEWER
- STORM SEWER TO REMAIN
- MODIFY EXISTING STORM SEWER TO MATCH NEW ALIGNMENT
- REPLACE EXISTING STORM SEWER WITH NEW CATCH BASIN OR STORM SEWER
- REMOVE/ABANDON EXISTING STORM SEWER

GENERAL

- PROPERTY LINE
- CATCHMENT BOUNDARY LINE
- REGULATORY FLOODLINE
- G13 CROSSING ID
- G13 4.5HA CATCHMENT ID / CATCHMENT AREA

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QEW AND HIGHWAY 403 (FREEMAN) INTERCHANGE
TRANSPORTATION ENVIRONMENTAL STUDY REPORT
MTO Project # 2016-E-0005

Exhibit 7-4C
Drainage and Stormwater Management Plan

KING Rd
16+103.289
INDIAN CREEK TRIB.
I-1B
78.60HA
SKYVIEW DR
WESTHAGER CREEK TRI 1
WESTHAGER
155HA
I-3B
105.90HA
I-4B
29.80HA
Ø1200mm
NORTH SERVICE RD
ROADWAY PROFILE
LOW POINT
IW-MAIN
16+000
HWY 403 WBL
MATCH LINE
438.84
HWY 403
STM
45+500
MATCH LINE
LDA-7
403 TO FAIRVIEW ST
INDIAN CREEK TRIB.
IW3
IW2
HYDRO LN
HRP 7
IW3
2.50HA
IW-MAIN
7.40HA
INDIAN CREEK EAST BRANCH
INDIAN CREEK WEST BRANCH

LEGEND

DRAINAGE/STORMWATER

- MAJOR/OVERLAND FLOW DIRECTION
- CULVERT FLOW DIRECTION
- MINOR FLOW DIRECTION
- HRP 3 — HYDROLOGIC REFERENCE POINT
- PROPOSED SWM FACLITY
- ENHANCED/GRASSED SWALE

WATER CROSSING

- PROPOSED (NEW) CROSSING
- EXISTING CROSSING TO REMAIN
- EXISTING CROSSING TO BE EXTENDED
- EXISTING CROSSING TO BE REPLACED
- REMOVE/ABANDON EXISTING CROSSING
- EXISTING CULVERT

STORM SEWER

- STM — PROPOSED NEW STORM SEWER
- STORM SEWER TO REMAIN
- MODIFY EXISTING STORM SEWER TO MATCH NEW ALIGNMENT
- REPLACE EXISTING STORM SEWER WITH NEW CATCH BASIN OR STORM SEWER
- REMOVE/ABANDON EXISTING STORM SEWER

GENERAL

- PROPERTY LINE
- CATCHMENT BOUNDARY LINE
- REGULATORY FLOODLINE
- G13 — CROSSING ID
- G13 4.5HA — CATCHMENT ID / CATCHMENT AREA

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QEW AND HIGHWAY 403 (FREEMAN) INTERCHANGE
TRANSPORTATION ENVIRONMENTAL STUDY REPORT
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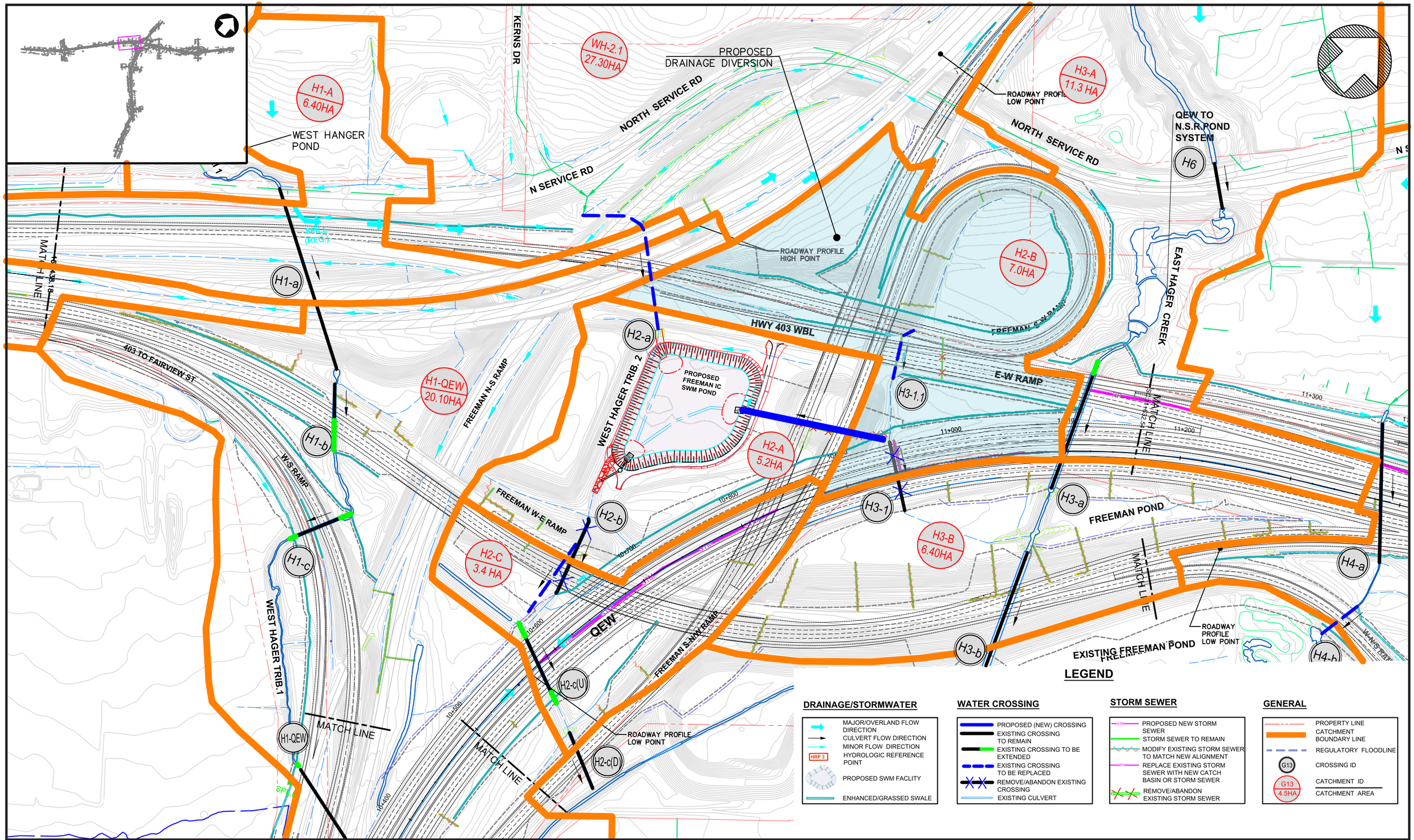
Exhibit 7-4D
Drainage and Stormwater Management Plan



LEGEND

DRAINAGE/STORMWATER

- MAJOR/OVERLAND FLOW DIRECTION
- CULVERT FLOW DIRECTION
- MINOR FLOW DIRECTION
- HRP 3 — HYDROLOGIC REFERENCE POINT
- PROPOSED SWM FACLITY
- ENHANCED/GRASSED SWALE

WATER CROSSING

- PROPOSED (NEW) CROSSING
- EXISTING CROSSING TO REMAIN
- EXISTING CROSSING TO BE EXTENDED
- EXISTING CROSSING TO BE REPLACED
- REMOVE/ABANDON EXISTING CROSSING
- EXISTING CULVERT

STORM SEWER

- PROPOSED NEW STORM SEWER
- STORM SEWER TO REMAIN
- MODIFY EXISTING STORM SEWER TO MATCH NEW ALIGNMENT
- REPLACE EXISTING STORM SEWER WITH NEW CATCH BASIN OR STORM SEWER
- REMOVE/ABANDON EXISTING STORM SEWER

GENERAL

- PROPERTY LINE
- CATCHMENT BOUNDARY LINE
- REGULATORY FLOODLINE
- G13 — CROSSING ID
- G13 / 4.5HA — CATCHMENT ID / CATCHMENT AREA

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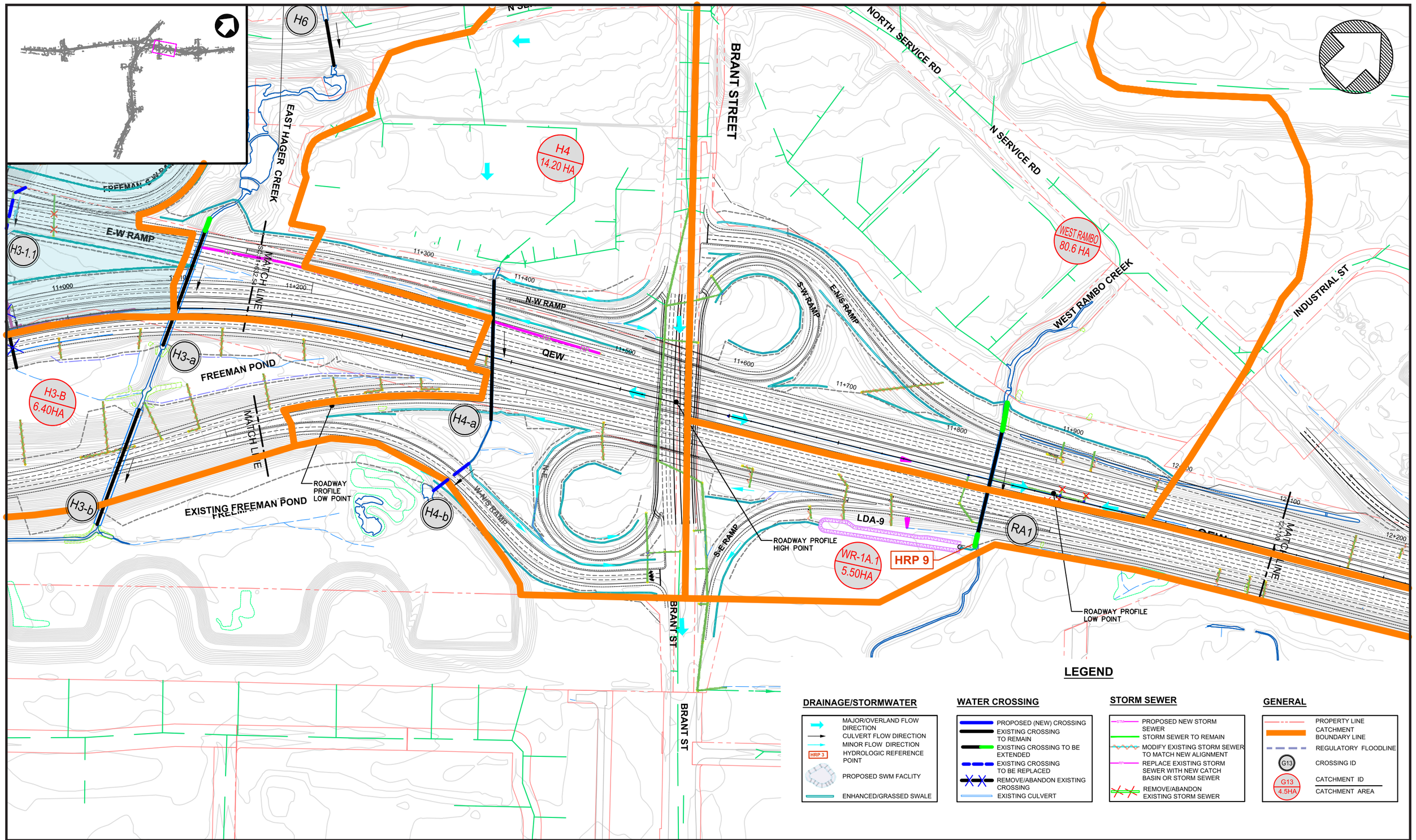
QEW AND HIGHWAY 403 (FREEMAN) INTERCHANGE
TRANSPORTATION ENVIRONMENTAL STUDY REPORT
MTO Project # 2016-E-0005

Exhibit 7-4E
Drainage and Stormwater Management Plan



LEGEND

DRAINAGE/STORMWATER

- MAJOR/OVERLAND FLOW DIRECTION
- CULVERT FLOW DIRECTION
- MINOR FLOW DIRECTION
- HRP 3 — HYDROLOGIC REFERENCE POINT
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WATER CROSSING

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QEW AND HIGHWAY 403 (FREEMAN) INTERCHANGE
TRANSPORTATION ENVIRONMENTAL STUDY REPORT
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Exhibit 7-4F
Drainage and Stormwater Management Plan

EAST RAMBO CREEK

EAST RAMBO POND

ER-1.1
16.80HA

ER-1A.1
14.0HA

ER-1W

ER-1E

LDA-11

NORTH SERVICE RD

QEW

LDA-10

IE1

ROADWAY PROFILE
HIGH POINT

ROADWAY PROFILE
LOW POINT

HRP 10

HRP 11

QUEENSWAY DR

GUELPH N-W RAMP

GUELPH W

MATCH LINE

CANADIAN NATIONAL RAILWAY

PLAINS RD E

BRENDA CRESCENT

12+100
12+200
12+300
12+500
12+600
12+700
12+800
12+900
13+000
13+100
13+200

LEGEND

DRAINAGE/STORMWATER

- MAJOR/OVERLAND FLOW DIRECTION
- CULVERT FLOW DIRECTION
- MINOR FLOW DIRECTION
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QEW AND HIGHWAY 403 (FREEMAN) INTERCHANGE
TRANSPORTATION ENVIRONMENTAL STUDY REPORT
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Exhibit 7-4G
Drainage and Stormwater Management Plan

NORTH SERVICE RD

ROSELAND
320.8 HA

ROSELAND CREEK

STUDY LIMIT

GUELPH S-W RAMP

GUELPH E-N/S RAMP

GUELPH LINE

ER-1A.1
14.0HA

ER-1E

LDA-11

13+100

13+200

GUELPH N-W RAMP

13+300

13+400

13+500

MATCH LINE

GUELPH W-N/S RAMP

GUELPH N-E RAMP

GUELPH LINE

S SERVICE Rd

RL1

HRP 14

ROADWAY PROFILE
LOW POINT

LEGEND

DRAINAGE/STORMWATER

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- CULVERT FLOW DIRECTION
- MINOR FLOW DIRECTION
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QEW AND HIGHWAY 403 (FREEMAN) INTERCHANGE
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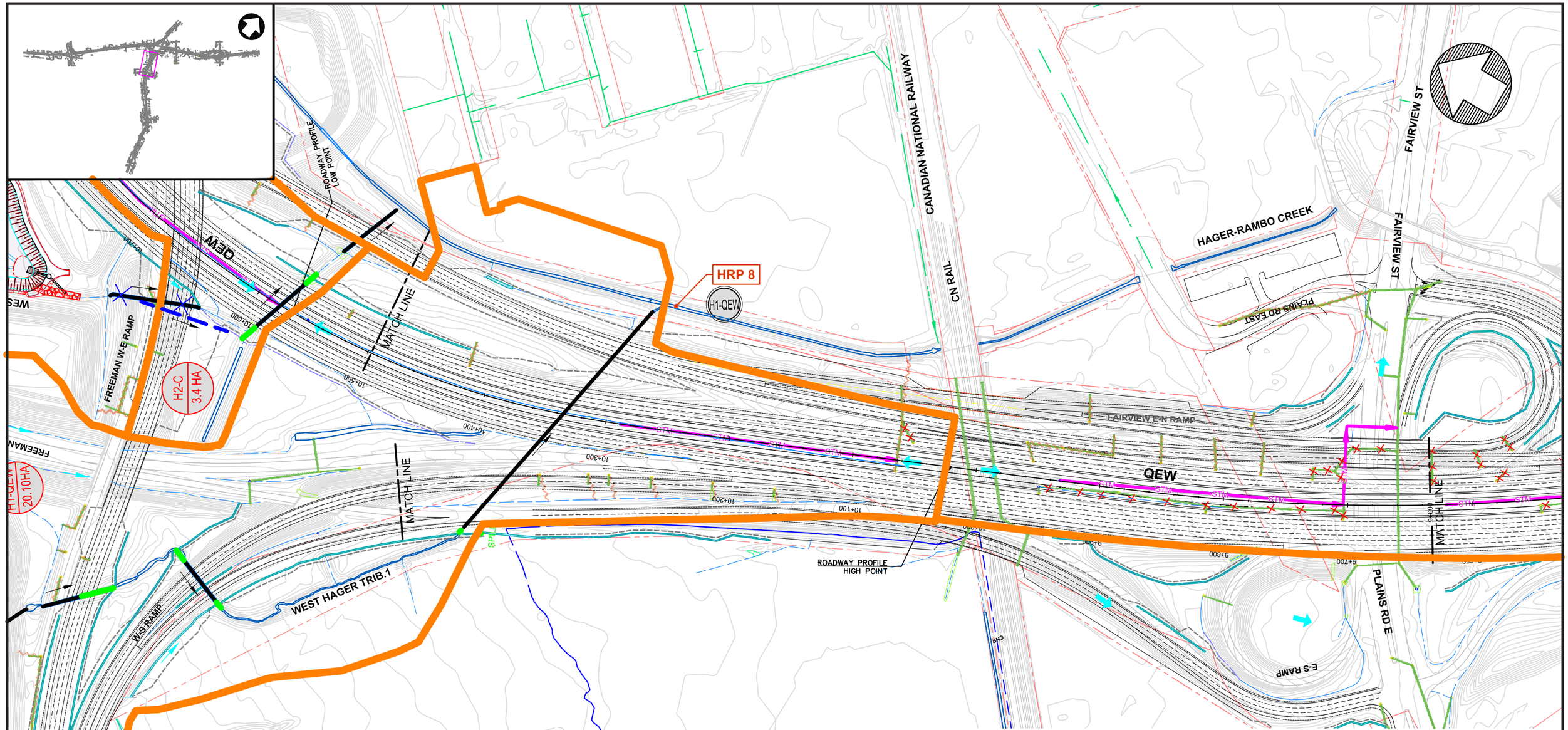
Exhibit 7-4H
Drainage and Stormwater Management Plan



LEGEND

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QEW AND HIGHWAY 403 (FREEMAN) INTERCHANGE
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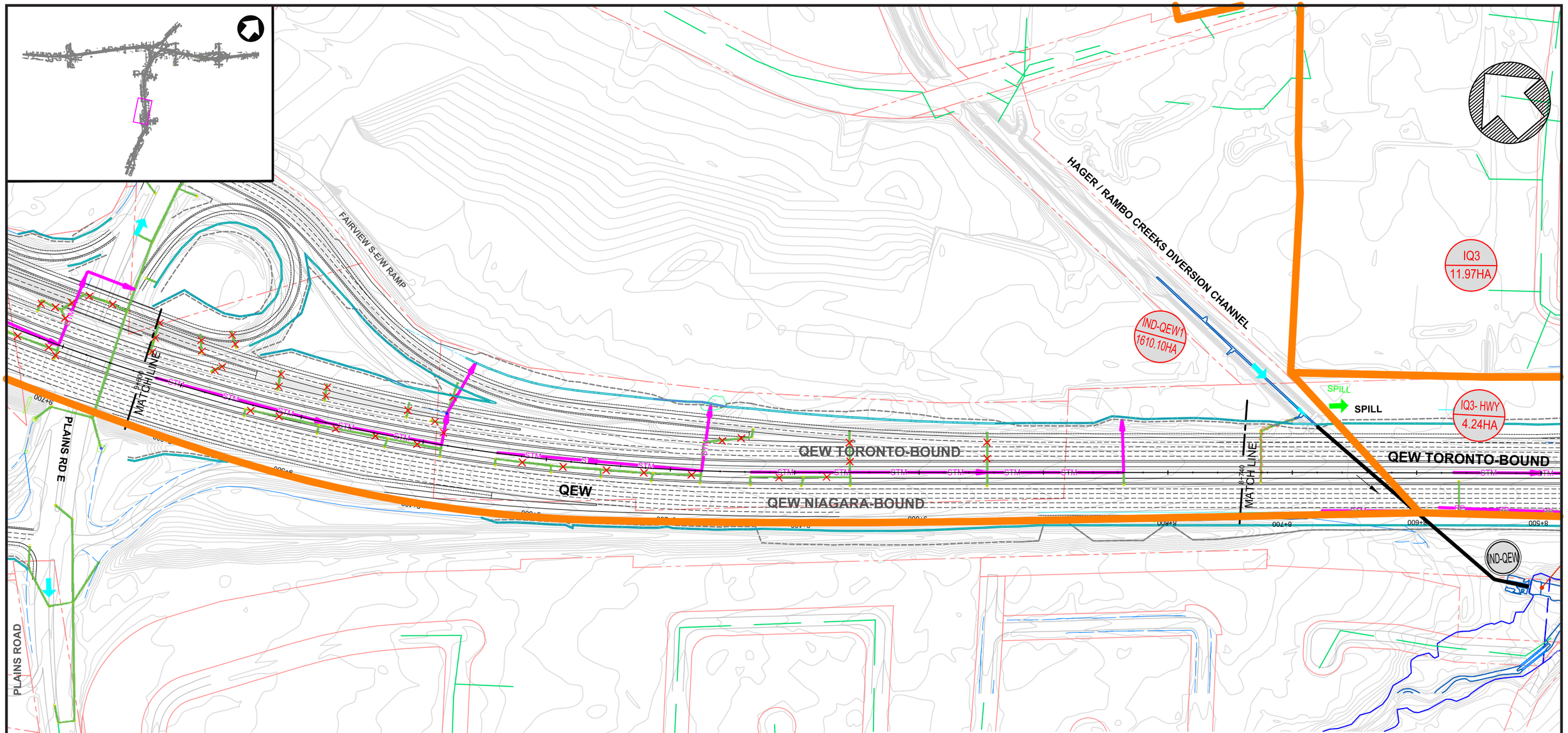
Exhibit 7-4I
Drainage and Stormwater Management Plan



LEGEND

DRAINAGE/STORMWATER

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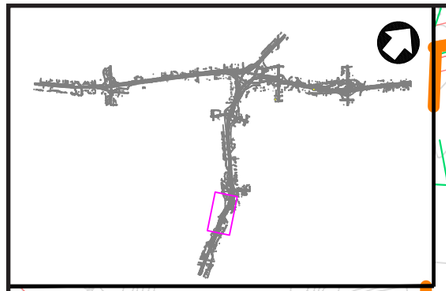
QEW AND HIGHWAY 403 (FREEMAN) INTERCHANGE
TRANSPORTATION ENVIRONMENTAL STUDY REPORT
MTO Project # 2016-E-0005

Exhibit 7-4J
Drainage and Stormwater Management Plan



HAGER / RAMBO CREEKS DIVERSION CHANNEL

IND-QEW1
1610.10HA

IQ3
11.97HA

IQ2
6.61HA

SPILL

IQ3- HWY
4.24HA

IQ3

IQ2-HWY
4.80HA

IQ2

ROADWAY PROFILE
LOW POINT

ROADWAY PROFILE
HIGH POINT

NORTH SHORE E-N RAMP

QEW TORONTO-BOUND

QEW NIAGARA -BOUND

MATCH LINE

MATCH LINE

IND-QEW

HRP 12

INDIAN CREEK

NORTH SHORE N-E/W RAMP

IND-QEW2
2242.10HA

IND-QEW 2

NORTH SHORE

LEGEND

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QEW AND HIGHWAY 403 (FREEMAN) INTERCHANGE
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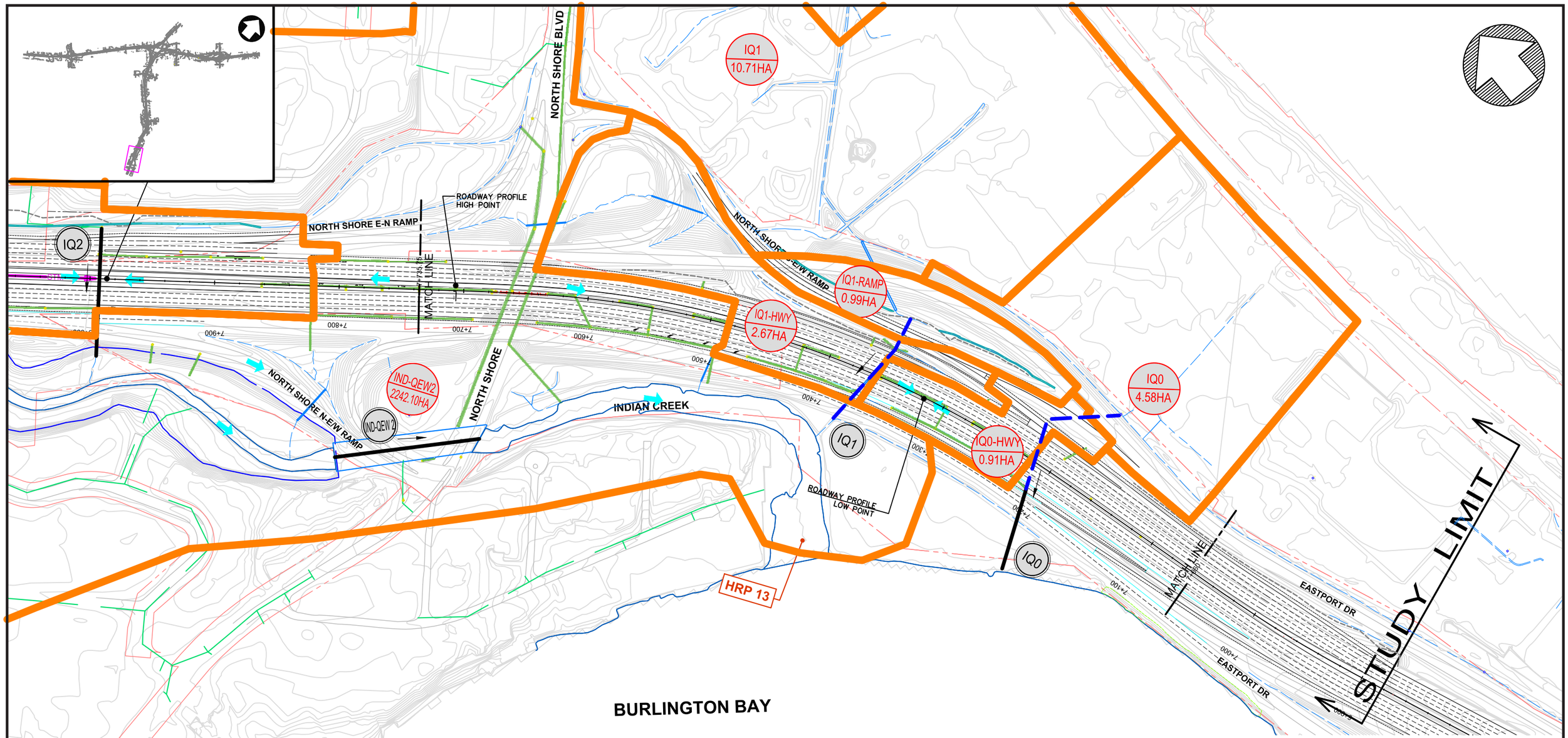
MTO Project # 2016-E-0005

Exhibit 7-4K
Drainage and Stormwater Management Plan



LEGEND

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QEW AND HIGHWAY 403 (FREEMAN) INTERCHANGE
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Exhibit 7-4L
Drainage and Stormwater Management Plan

7.6 STRUCTURES

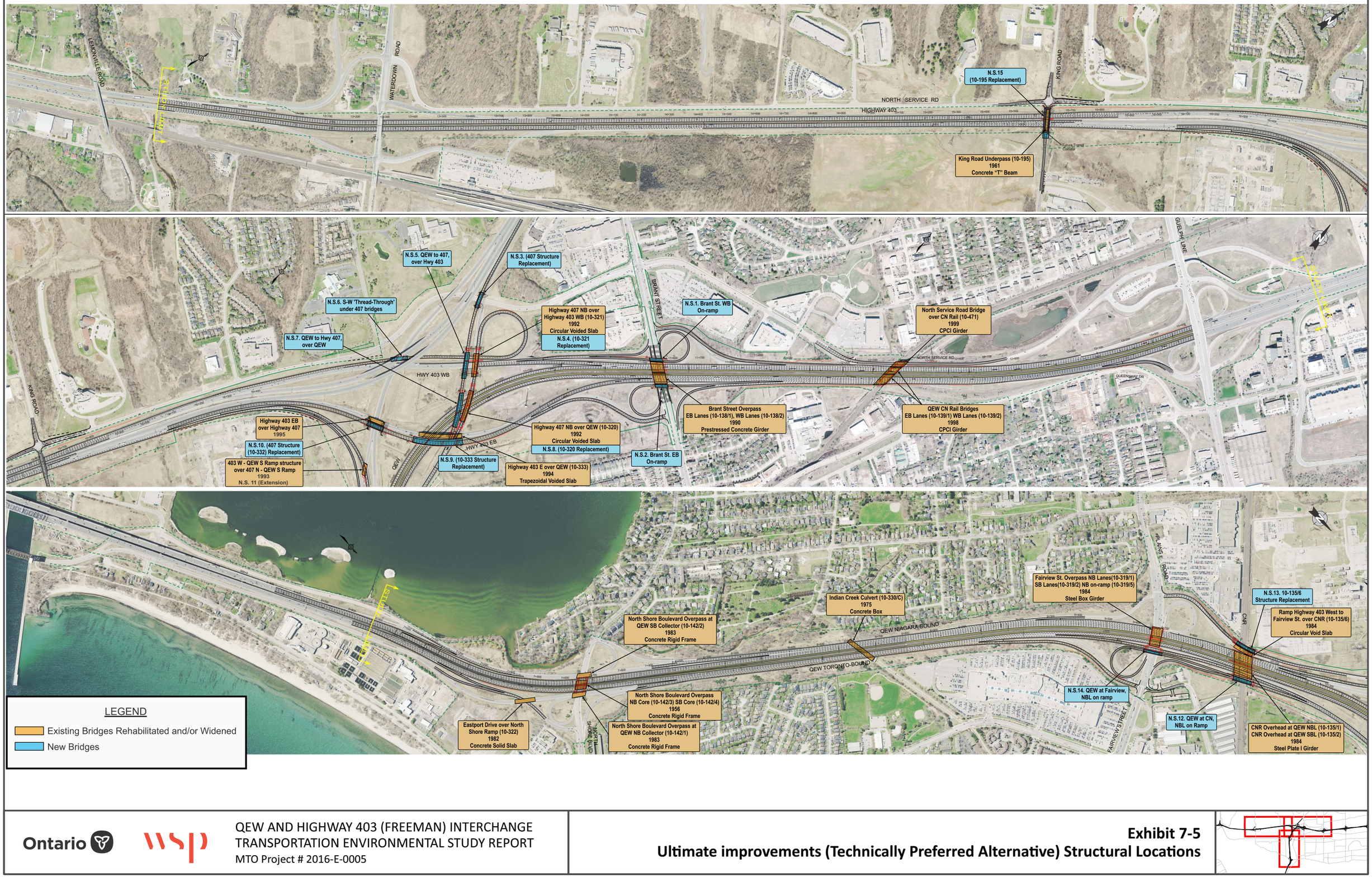
Table 7-2 summarizes the structural work within the study area required due to the proposed improvements, and what phase the improvements will occur. The locations of the new and existing-improved structures are detailed in **Exhibit 7-5.**

All existing MTO structures within the study area, apart from those at the North Shore Boulevard Interchange, will require improvements by the project horizon, either due to their typical rehabilitation cycles or the proposed improvements. Five structures owned, or share-owned with MTO, by 407 ETR will also be impacted by the improvements. 407 ETR have been consulted as part of this study and consultation will be continued through later design phases. A total of 15 new structures are required to implement the improvements.

Table 7-2: Proposed Structures

Existing ID/ New Structure (N.S. #)	Name and Location	Proposed Improvements	Phase		
			Imm.	Int.	Ult.
10-139/1	QEW at CN Rail EB, between Brant Street and Guelph Line	Rehabilitate and widen to outside		✓	
10-139/2	QEW at CN Rail WB, between Brant Street and Guelph Line	Rehabilitate and widen to outside		✓	
10-471	North Service Road over CN Rail	Partial Deck Demolition		✓	
10-138/1	QEW at Brant St. EB Overpass	Widen into median	✓		
10-138/2	QEW at Brant St. WB Overpass	Widen into median	✓		
N.S. 1	Brant St. WB Inner Loop On-ramp	On-ramp accommodated on new structure			✓
N.S. 2	Brant St. EB Inner Loop On-ramp	On-ramp accommodated on new structure			✓
407 ETR Structure	QEW to 407 ETR, over North Service Road	Existing bridge demolished			✓
N.S. 3 (407 Structure Replacement)	QEW to 407 ETR, over North Service Road	New structure west of existing 407 ETR structure			✓
10-321	QEW to 407 ETR / 403, over Hwy 403	Rehabilitate (immediate) and Demolition (ultimate)	✓		✓
N.S.4 (10-321 Replacement)	QEW to 407 ETR / 403, over Hwy 403	Replacement structure for 10-321			✓
N.S. 5	QEW to 407 ETR, over Hwy 403	New structure west of 10-321			✓
N.S. 6	Freeman IC S-W Ramp 'Thread-Through' Structure	New structure under 407 ETR to Hwy 403 WB and over Hwy 403 EB to 407 ramp structures		✓	
N.S. 7	QEW to 407 ETR / 403, over QEW	New structure west of 10-320			✓
10-320	QEW to 407 ETR / 403, over QEW	Rehabilitate (immediate) and Demolition (ultimate)	✓		✓
N.S. 8 (10-320 Replacement)	QEW to 407 ETR / 403, over QEW	Replacement structure for existing 10-320			✓
10-333	Hwy 403 EB to QEW EB, over QEW	Demolition		✓	
N.S. 9 (10-333 Replacement)	Hwy 403 EB to QEW EB, over QEW	Replacement structure for 10-333, south of existing		✓	
407 ETR Structure (10-332)	Hwy 403 EB to QEW EB, over 407 to QEW SB Ramp	Demolition		✓	
N.S. 10 / 407 ETR Structure (10-332) Replacement	Hwy 403 EB to QEW EB, over 407 ETR to QEW SB Ramp	Replacement structure for 10-332, south of existing		✓	

Existing ID/ New Structure (N.S. #)	Name and Location	Proposed Improvements	Phase		
			Imm.	Int.	Ult.
N.S.11 / 407 ETR Structure – Widening	403 W - QEW S ramp structure–over 407 ETR N - QEW S ramp	Extension of existing structure			✓
10-135/1	QEW at CN Rail NBL, North of Fairview	Rehabilitation	✓		
10-135/2	QEW at CN Rail SBL, North of Fairview	Rehabilitate and widen into median	✓		
N.S.12	QEW at CN Rail, NBL from Fairview Street on-ramps	New structure, east of the NB QEW CNR Overhead			✓
10-135/5	Ramp from Fairview Street to Hwy 403 over CNRQEW at CN Rail NBL, North of Fairview	Rehabilitation	✓		
10-135/6	Highway 403 to Fairview off-ramp, over CNR. SBL Ramp HWY 403 to Fairview	Rehabilitate (interim) and Demolition (ultimate)	✓		✓
N.S. 13 / 10-135/6 Replacement	Highway 403 to Fairview off-ramp, over CNR. SBL Ramp HWY 403 to Fairview	Replacement of existing structure to west			✓
10-319/1	QEW at Fairview	Rehabilitate and widen into median	✓		
10-319/2	QEW at Fairview	Rehabilitate	✓		
10-319/5	QEW at Fairview	Rehabilitate	✓		
N.S 14	QEW at Fairview, NBL on ramp	New structure to the east of the NB overpass (interim). New structure widened (ultimate)		✓	✓
10-142/1	North Shore Blvd Collectors	Rehabilitated in 2018 as part of a separate assignment.	N/A		
10-142/2	North Shore Blvd Collectors	Rehabilitated in 2018 as part of a separate assignment.	N/A		
10-142/3	QEW at North Shore Boulevard/Express	Replacement of structure as part of a separate assignment (completion scheduler in 2021).	N/A		
10-142/4	QEW at North Shore Boulevard/Express	Replacement of structure as part of a separate assignment (completion scheduled in 2021).	N/A		
10-322	Eastport Drive Over North Shore Ramp	Rehabilitated in 2018 as part of a separate assignment.	N/A		
10-195/ N.S. 15	King Road Underpass	Demolition and replacement of existing structure while maintaining current alignment		✓	



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QEW AND HIGHWAY 403 (FREEMAN) INTERCHANGE
TRANSPORTATION ENVIRONMENTAL STUDY REPORT
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Exhibit 7-5
Ultimate improvements (Technically Preferred Alternative) Structural Locations

7.7 FUTURE TRAFFIC CONDITIONS

A Traffic Analysis Report was completed as part of this study and is included in **Appendix B**. The future operational performance of the proposed improvements is also overviewed to in **Section 3** as it relates to the needs and opportunities of the study.

The traffic analysis identified a preferred corridor improvement scenario (Scenario 2A) which recommended the following improvements by the project horizon (2041). These became the basis of short list alternatives which were evaluated to identify the Technically Preferred Alternative (the evaluation of alternatives is further detailed in **Section 5**).

- A new managed lane (i.e. HOV/HOT) along the QEW in both directions, from north of the Burlington Skyway to the existing HOV lane at the Guelph Line Interchange;
- An additional general-purpose lane in both directions along the QEW from the North Shore Boulevard Interchange to the Guelph Line Interchange; and
- An additional general-purpose lane in both directions along Highway 403.

7.7.1 FUTURE CONDITIONS – DO NOTHING

For comparison purposes, the existing freeway network was modelled under future traffic conditions and is referred to as the 'Do-Nothing' Scenario. Analysis of the 'Do-Nothing' scenario identified severe congestion throughout the study limits by the project horizon (2041), with bottlenecks occurring at the study limits due to similar capacity issues outside of the study area.

Exhibits 7-6 to 7-9 summarize the traffic performance 'Level of Service' (LOS) of the Do-Nothing scenario. A similar assessment of LOS for existing conditions was undertaken and this is detailed in **Section 4.4.7**. A key of the LOS criteria is included in **Table 4-6**. Comparing the existing conditions and the future Do Nothing scenario, the existing congestion will worsen in the future. The congestion is also focused around common focal points, including QEW Niagara-bound at Brant Street during the PM peak where there is a known lane balance issue today.

Exhibit 7-6: Level of Service (LOS) - Do Nothing - AM Peak

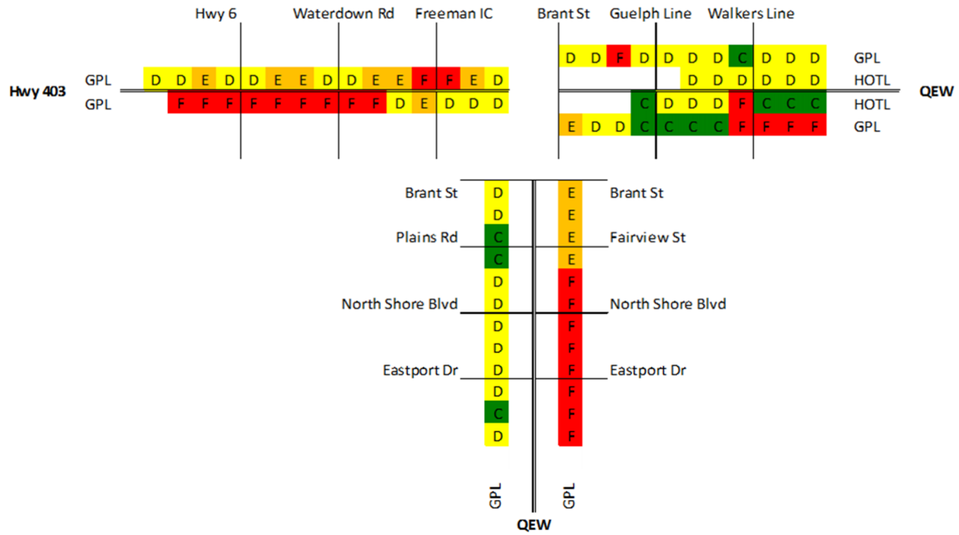


Exhibit 7-7: Level of–Service (LOS) – Do Nothing - PM Peak

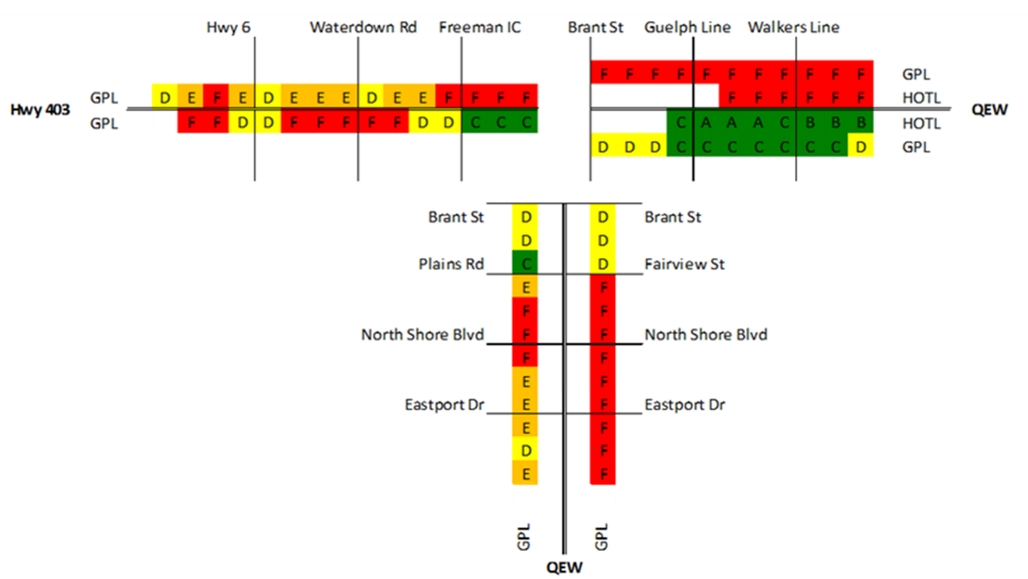


Exhibit 7-8: Level of Service (LOS) - Proposed– Improvements - AM Peak (2041)

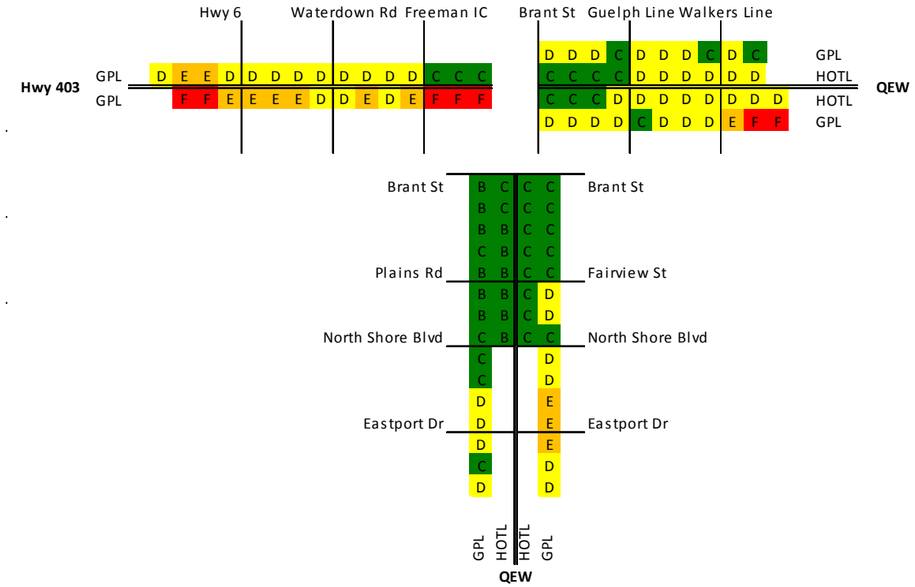
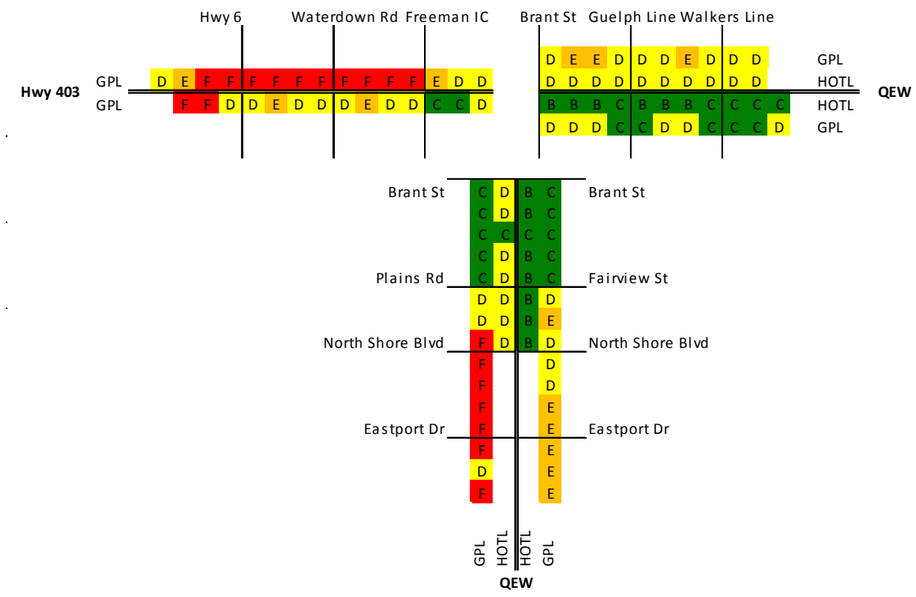


Exhibit 7-9: Level of Service (LOS) - Proposed– Improvements - PM Peak (2041)



7.7.2 FUTURE CONDITIONS – PROPOSED IMPROVEMENTS

Exhibits 7-8 and **7-9** summarize the traffic performance 'Level of Service' (LOS) of the preferred corridor improvement scenario (Scenario 2A). Compared to the 2041 'Do-Nothing', the preferred Scenario 2A resulted in:

- Overall, notable improvement in traffic operations and reduced congestion
- Highway 403
  - While overall congestion improved, congestion worsens in the Hamilton-bound direction towards Highway 6 in the PM Peak due to existing capacity constraints which lie outside the study area.
  - Toronto-bound congestion largely improved in both AM and PM Peaks.
- QEW
  - Severe congestion on the QEW Niagara-bound lanes at the split at Brant Street significantly improved.
  - While congestion improves overall, congestion worsens for QEW Niagara-bound on approach to the Burlington Skyway due to the need to reduce lanes to match the existing Skyway cross-section.
  - In AM Peak, congestion is improved on the QEW, around the Plains Road East/ Fairview Street Interchange and North Shore Boulevard Interchange. If the QEW east of the study limits remains the same as existing, there is potential for bottlenecking on the QEW, between Brant Street and Guelph Line. If the QEW is widened easterly of the study limits, through Halton, congestion through the Freeman Interchange study area is lessened.

Each of the future improvement scenarios had performance limitations due to the need to transition to match the existing number of lanes at the limits of the study area. Bottlenecks will be experienced on the QEW both east of the Guelph Line interchange (east of the study limits) and on the Burlington Skyway (south of the study limits). Therefore, to not limit the efficiency of this study's improvements and to avoid the Freeman Interchange itself being a bottleneck should the QEW either side of the limits be improved, the preferred corridor scenario (Scenario 2A) was also assessed assuming a widening of the QEW east of the study limits through Halton. Consideration can be made to implement the proposed ultimate improvements as part of a broader network capacity expansion plan. It is noted that these broader expansions, including widening to the east and/or south of the study limits, will be subject to further study and EA approval.

7.8 ILLUMINATION IMPROVEMENTS

The existing illumination within the study area is detailed in **Section 4.4.8.** For the ultimate condition (the technically preferred alternative), warrant analysis was conducted to confirm the future illumination needs and an assessment (including life-cycle cost analysis) of conventional (typical light poles) vs High Mast Lighting (HML) was conducted to identify the preferred illumination infrastructure. The following illumination improvements and/or recommendations are proposed.

Highway 403:

- At the Waterdown Road Interchange, full conventional (typical light-poles) illumination will be provided
- On the Highway 403 mainline between the Waterdown Road interchange and the King Road underpass, conventional illumination will be provided
- On the Highway 403 mainline between King Road underpass and the Freeman Interchange, existing High Mast Lighting will be upgraded.

QEW:

- At the Freeman Interchange, illumination will be High Mast Lighting
- At QEW Interchanges at Guelph Line, Brant Street, Plains Road East / Fairview Street and North Shore Boulevard, illumination will be High Mast Lighting
- For the QEW mainline throughout the study area, Conventional (typical light-poles) illumination will be provided.

LED lighting is also proposed, upgrading the existing High-Pressure Sodium (HPS) luminaires. The difference between the proposed condition and existing is summarized in **Table 7-3**. As shown in the table below, portions of freeway mainline within the study area currently have High Mast Lighting and, in the future, are proposed to have Conventional (typical light-poles) lighting. The typical benefits of using conventional over high mast lighting include life-cycle cost-savings and a reduction in light trespass.

Table 7-3: Summary of Proposed Illumination Improvements

Section	Existing	Proposed	Comments
Highway 403 Mainline (Waterdown Road to King Road)	Not illuminated	Full LED Conventional Lighting	LED Conventional lighting added
Highway 403 Mainline (King Road to Freeman Interchange)	Full Illumination with High Mast Lighting	Full LED conventional Lighting	Full LED lighting system replacement
Waterdown Road Interchange	Partial Conventional Lighting	Full LED Conventional Lighting	
QEW Interchanges (Freeman Interchange and Arterial Roads)	Full Illumination that either contain High Mast Lighting or Conventional Lighting	Full LED High Mast Lighting	
QEW Mainline (North Shore Boulevard to Freeman Interchange, and Freeman Interchange to Guelph Line)	Full Illumination that either contain HML or Conventional Lighting	Full LED Conventional Lighting	

7.9 UTILITIES

The existing utilities within the study area are detailed in **Section 4.4.9** and a preliminary utility composite plan is included in **Appendix G.** To accommodate the proposed improvements, there will be impacts and relocation requirements for some utilities within the study area. The preliminary assessment of utility relocations has been determined through subsurface utility engineering (SUE) investigations and consultation with the utility companies. Final impacts and required mitigation / relocation and will be confirmed during Detail Design.

As described in **Section 4.4.9**, Hydro One features prominently within the study area. There are five Hydro Transmission Corridor crossing locations over the QEW or Highway 403 within the study limits, all linking to a key Hydro One transmission station located to the southwest of the Freeman Interchange. Consultation with Hydro One was carried out during this Class EA study and will need to be continued further in Detail Design.

As the Hydro One infrastructure in some parts of the study area is as old as the QEW itself, there are towers within close proximity to the MTO Right-Of-Way (ROW). As a result, any freeway widening will reduce the offset to these towers. For the most part, direct conflict with towers have been avoided using

grading modifications (i.e. toe/retaining walls), apart from one location within the Freeman Interchange where towers are anticipated to require relocation due to the QEW widening. Also, in several locations within the study area, freeway infrastructure will be within the buffer area (15 m radius) desired by Hydro One for maintenance. It is noted that in some locations the existing freeway already encroaches into this maintenance buffer area.

The following locations are of note:

- North of the QEW, east of the Brant Street interchange, a hydro tower is located at the existing MTO ROW. The widening of the QEW reduces the offset between the freeway and tower from approximately 14 m to approximately 5 m.
- North of the QEW, east of CN Rail crossing, a hydro tower is located within the MTO ROW north of North Service Road. The improvements require a realignment of North Service Road and its grading would approach the tower. Impacts to the tower will be avoided through the use of toe/retaining walls.
- Southeast quadrant of the Freeman Interchange, west edge of Leighland Park, a hydro tower is located approximately 8 m from the QEW Toronto-bound ramp to Highway 403/407 ETR. The proposed improvements retain the existing alignment and thus the existing offset.
- South of the Freeman Interchange, prior to the merge of the 407 ETR/Highway 403 ramp with the QEW Niagara-bound lanes, three hydro towers are located between the QEW Niagara-bound lanes and the ramp, approximately 8 m from the QEW lanes. Due to the interim QEW widening, this offset will reduce to approximately 4 m. In the ultimate condition, the QEW widening will have direct conflicts with these towers and their relocation will be required.
- South of Freeman Interchange, northwest of the CN Rail Crossing, the existing Highway 403 to Fairview Street exit ramp is approximately 39 m from the edge of the transmission station and a tower. The proposed improvements require the realignment of this ramp, and the distance between will reduce to approximately 25 m. Retaining walls are proposed along this ramp to avoid impacts to the transmission station and maintain the minimum offset at approximately 25 m along the ramp's length.
- South of Highway 403, west of the Freeman Interchange, the transmission station and towers are located approximately 35 m from the highway. The widening of Highway 403 will reduce this offset to approximately 25 m. Retaining walls are proposed to mitigate impacts and maintain offset at a minimum 25 m. A maintenance road (Jobs Lane) is located between the transmission station and Highway 403 and toe/retaining walls are proposed along Highway 403 to minimize impacts and enable the maintenance road to be retained and remain operational.
- King Road Underpass Replacement. A Hydro Transmission line crosses King Road approximately 100 m south of the structure. The structural replacement will require an elevation raise of the roadway (as the new structure will be higher than the existing), thus impacts to existing vertical clearances at the transmission line crossing are anticipated. A Hydro One access road for tower maintenance, that intersects with King Road, will also require regrading. Mitigations required will be confirmed though further consultation with Hydro One and through the completion of the final design in the Detail Design phase.

At each of the Hydro One transmission line crossings, the freeway platform will be widened. As the existing freeway and structures are being widened, changes to the existing vertical alignments will be minimal and so impacts to existing vertical clearances at transmission line crossings are anticipated to be small. However, vertical clearances will have to be confirmed in Detail Design. Typical mitigation measures could include tightening the lines or decreasing the line span lengths, and these will be confirmed in later design phases. Hydro One has been consulted and has completed an initial review of the proposed designs, however the detail and assessment of proposed remediation measures will have to be completed in the Detail Design phase, once the final design of the highway improvements has been completed.

7.10 PROPERTY REQUIREMENTS

For most of the study area, the improvements will be accommodated within the existing MTO Right-Of-Way (ROW). While the QEW is being widened, grading modifications including toe/retaining walls help mitigate property impacts. Temporary limited interests will likely be required adjacent to locations of higher retaining walls to aid construction, details of which will be confirmed in later design phases. The locations of higher retaining walls include the south side of the QEW, between the Brant Street and Guelph Line interchanges, and the east side of the QEW, northeast of the Plains Road East / Fairview Street Interchange.

For the proposed improvements, property will be required:

- In the southwest quadrant of the Guelph Line interchange, to accommodate the QEW Toronto-bound (eastbound) exit ramp improvements.
- Northeast of King Road, to accommodate the realigned North Service Road which is a resultant of the King Road and Highway 403 underpass structure replacement.
- In the northwest quadrant of the Freeman Interchange. While the proposed QEW to Highway 403 (westbound) improvements will not require the realignment of North Service Road, the grading of the improvements will extend into the municipal road's ROW.

- In the southwest quadrant of the Freeman Interchange. While grading modifications and/or toe walls are proposed to mitigate impacts, two small segments of property will be required from the Hydro One Transmission station. The property requirement will not prohibit the use of the existing maintenance road (Jobs Lane) that currently circumvents the transmission station. Hydro One were consulted on the proposed property requirement and have provided a conditional approval, including mitigation requirements to be referred to in the subsequent detail design phase (correspondence included in **Appendix K**).

Property requirements are detailed in the Ultimate Improvements (Technically Preferred Alternative) preliminary design plates included in **Appendix A.**

7.11 CONSTRUCTION STAGING

A Preliminary Construction Staging plan has been completed as part of this study and staging strategies have been identified for each of the three improvement phases: immediate, interim and ultimate improvements.

7.11.1 IMMEDIATE IMPROVEMENTS: QEW STRUCTURAL REHABILITATION STAGING

The immediate improvements constitute the rehabilitation of bridges at three locations on the QEW:

- Brant Street Interchange Overpasses (Toronto-bound and Niagara-bound)
- CN Rail Overhead Structures, north of Fairview Street
  - Toronto-bound and Niagara-bound Overhead Structures
  - Highway 403 to Fairview Street exit ramp structure over CN Rail.
- Plains Road East / Fairview Street Interchange Overpass Structures (Toronto-bound and Niagara-bound).

The rehabilitation of these structures will require widening of the QEW mainline structures, with traffic staging and/or detouring. No property is required outside of the MTO right-of-way for the rehabilitation construction staging.

Widening of the bridges as part of the rehabilitation work will ensure that QEW lane closures due to construction are limited to off-peak/night-time periods. Throughout the duration of the rehabilitation, there will be a number of short-term, temporary ramp closures and traffic disruptions. There will also be two longer-term ramp closures at the Brant Street Interchange and the Plains Road East / Fairview Street Interchange that are necessary to facilitate construction.

At the Brant Street Interchange, the inner-loop entrance ramp to the Highway 403 Hamilton-bound lanes is anticipated to require closure for approximately half a construction season. The traffic is expected to detour via North Service Road to access Hamilton-bound Highway 403 from Waterdown Road or use Fairview Street / Plains Road East to access Hamilton-bound Highway 403 from Waterdown Road.

At the Plains Road East / Fairview Street Interchange, the inner-loop entrance ramp to Highway 403 / 407 ETR is anticipated to require two periods of closure, each approximately half a construction season, at separate points of the construction. The traffic is expected to detour to Highway 403 by either the Brant Street or Waterdown Road interchanges, and to 407 ETR from Highway 403 or the Dundas Street interchange.

The total duration of rehabilitation works on both the Brant Street overpasses and the Plains Road East/ Fairview Street interchange are anticipated to last two to three construction seasons.

Construction staging plans and details will be further refined in subsequent design phases and confirmed in Detail Design, in consultation with key stakeholders including the City of Burlington, Halton Region and 407 ETR.

7.11.2 INTERIM IMPROVEMENTS STAGING

The interim improvements are detailed in **Section 7.1.2**, and in summary include:

- QEW:
  - Widening of the QEW to accommodate one new HOV lane in each direction between Guelph Line and the Burlington Skyway.
- Highway 403:
  - Widening of Highway 403 to accommodate one additional general-purpose lane in each direction, from the Freeman Interchange to west of Waterdown Road.
- Freeman Interchange:
  - Constructing a new Highway 403 Toronto-bound to QEW Toronto-bound ramp through the Freeman Interchange, that accommodates one more lane than the existing ramp.
  - Realigning the QEW Toronto-bound to Highway 403 Hamilton-bound ramp, enabling more Hamilton-bound lanes to be carried from QEW to Highway 403.
- Arterial road interchanges:
  - Brant Street Niagara-bound off-ramp realigned to improve geometry
  - Guelph Line Toronto-bound off-ramp realigned to improve geometry

- Plains Road / Fairview Street east ramp terminal shifted easterly to accommodate QEW widening, with realignments to the northbound on-ramps.

The following sections provide an overview of how the interim improvements will be staged, with durations and construction schedule discussed at the end of this section.

The interim improvements will also include the construction of the drainage improvements proposed by this study. The drainage improvements include the construction of two new structural culverts on Highway 403, on approach to the QEW and Highway 403 (Freeman) Interchange. The culverts will be constructed in two overall stages, with the mainline lanes shifted towards the median and towards the outside, respectively. It is anticipated that the staging will be accommodated on the widened highway platform required by the proposed mainline improvements, thus no additional property is required, and the staging would result in minimum throwaway costs. Long-term lane reduction is not anticipated to be required, however there may be short-term and/or overnight lane closures and traffic disruption during construction staging and the shifting of lanes. The IW-Main culvert improvements also include a new structural culvert recommended under North Service Road, north of Highway 403. At the culvert location, the North Service Road pavement width is relatively large with a painted median and paved shoulders, and so it is anticipated to accommodate the shifting of traffic lanes under staging conditions. Should it be required over short durations, traffic may be reduced to a single lane with temporary traffic signals facilitating traffic control. Temporary closure of the sidewalk and cycle lanes is anticipated during the construction. Final staging plan will be confirmed in Detail Design and in further consultation with the City of Burlington.

7.11.2.1 *QEW INTERIM IMPROVEMENTS STAGING*

Through much of the study area, the existing QEW has an open/grassed median of varying width approximately 15 m wide. By the time of the interim improvements, this would have changed as some sections of the existing median would have been reconstructed as part of the immediate improvement phase (i.e., bridge rehabilitation work), along with the median widening of the QEW mainline structures. In principle, the QEW traffic will be maintained during construction by shifting the QEW lanes to the outside and using a work-zone in the median to complete the remaining improvements. **Exhibit 7-10** illustrates this approach, using the QEW through the Freeman Interchange as an example location.

The traffic staging plan identified by this study has been developed with a priority on maintaining the existing number of QEW and Highway 403 lanes during peak traffic periods throughout construction, thus mitigating traffic impacts. Some off-peak/night-time QEW lane closures will be required to provide construction site access and egress for larger construction vehicles and/or deliveries.

CN RAIL OVERHEAD, BETWEEN BRANT STREET AND GUELPH LINE (QEW EAST LEG)

The QEW CN Rail Overhead crossing, located between the Brant Street and Guelph Line interchanges, is anticipated to require rehabilitation around the same time that the interim improvements are required. To accommodate the widening of the QEW, the existing CN Rail crossing structure will need to be widened, and this widening will also provide the opportunity to rehabilitate the structure while maintaining traffic. As part of the QEW CN Rail Overhead widening, it is necessary to realign North Service Road and partially demolish the North Service Road structure deck over CN Rail. To facilitate the structural improvements, North Service Road will be temporarily reduced to one lane over the structure, with temporary traffic signals facilitating traffic control. As the southern half of the existing North Service Road structure deck is being demolition, the sidewalk located on the northern side will not be impacted by the improvements and thus anticipated to remain open during construction.

QEW AT NORTH SHORE BOULEVARD INTERCHANGE

Minimal platform widening is anticipated to be required for the QEW immediately north and south of the North Shore Boulevard interchange for the interim improvements. This is because the QEW platform would have already been widened for staging purposes during the replacement of the overpasses, which is being conducted prior to the improvements proposed by this study, as detailed in **Section 1.4**.

7.11.2.2 *HIGHWAY 403 INTERIM IMPROVEMENTS STAGING*

Highway 403 has an open/grassed median with a width of approximately 15 m. This provides opportunity for construction staging as the existing lanes can be shifted to the outside, using the outside shoulders, and a work zone can be provided in the median. As Highway 403 is being widened into the median, it means no ramp realignments are required at the Waterdown Road interchange. **Exhibit 7-11** illustrates the construction staging approach for the Highway 403 mainline.

Exhibit 7-10 Interim Improvements Staging – QEW Widening Approach

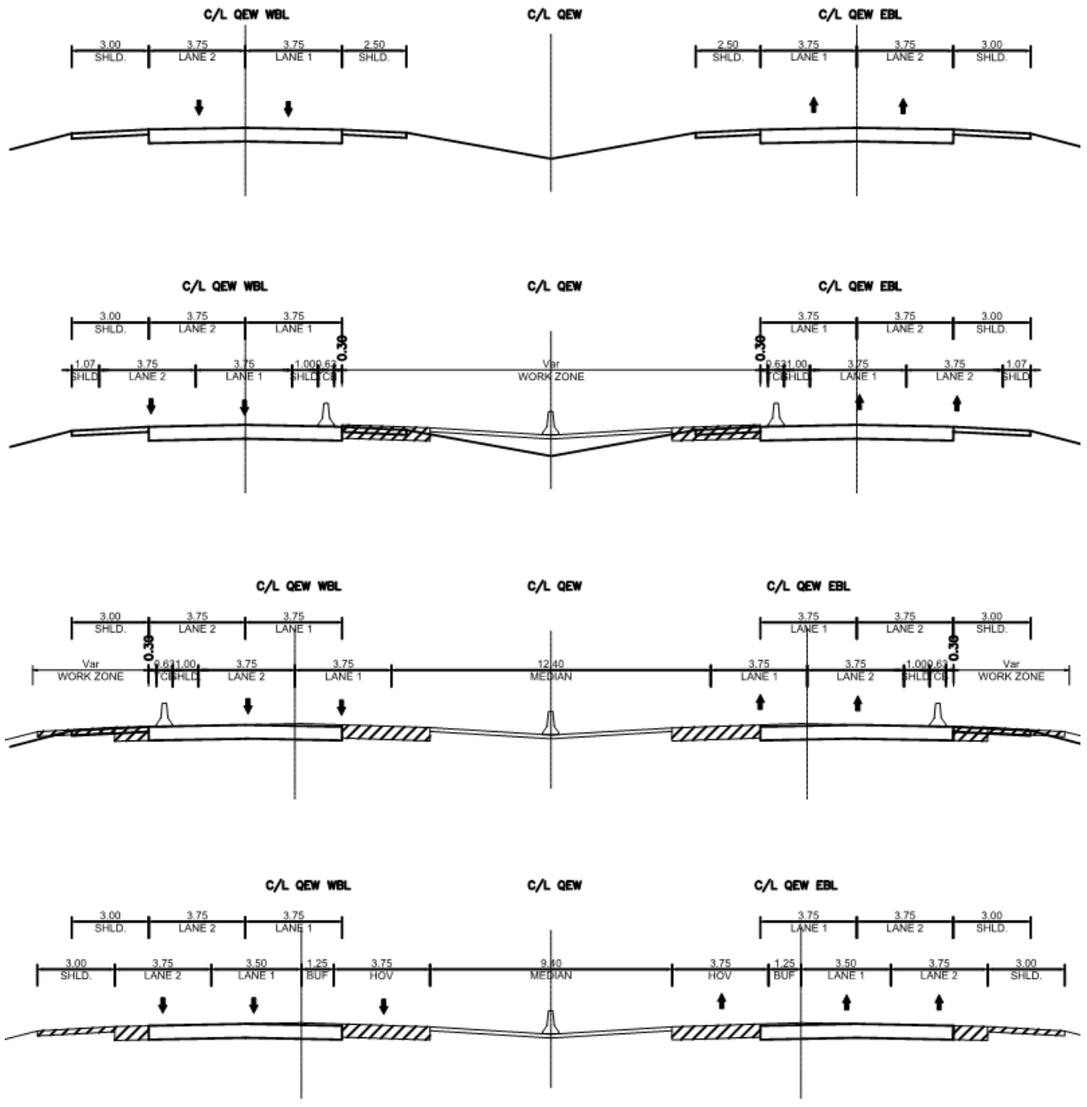
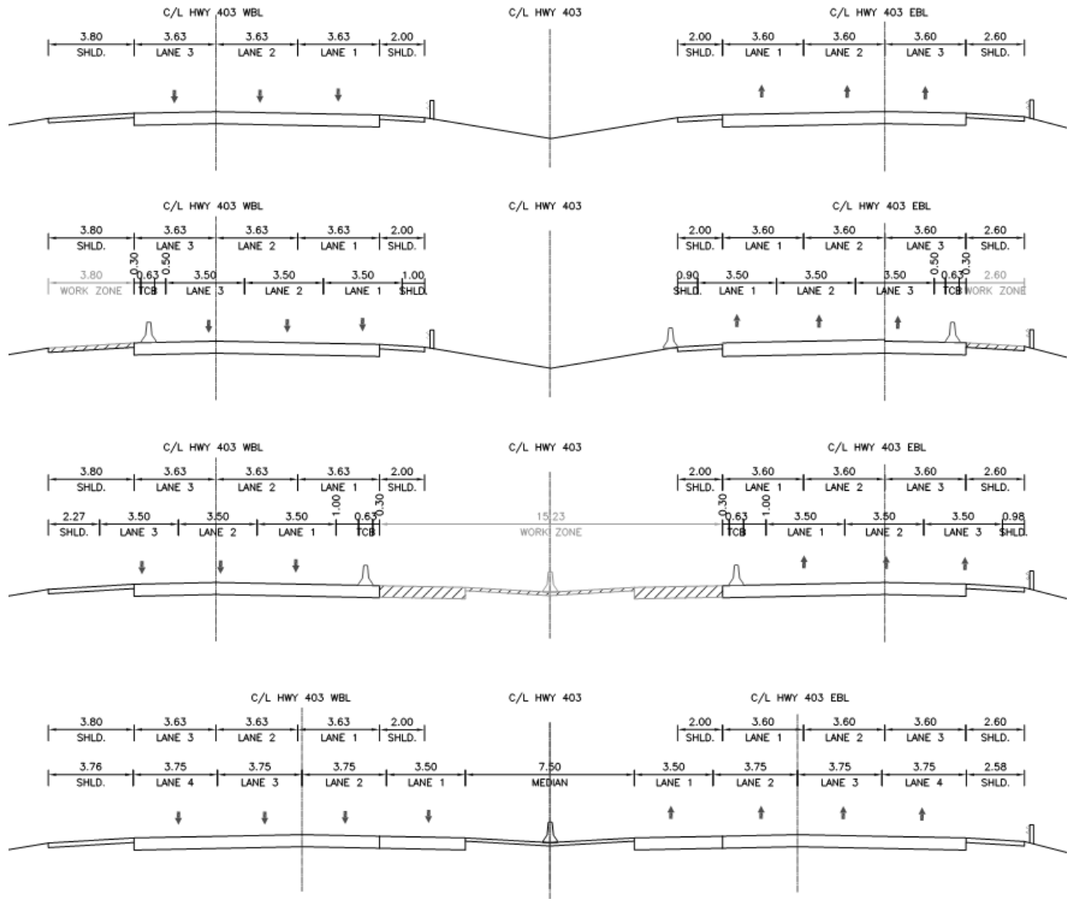


Exhibit 7-11 Highway 403 Construction Staging Typical Sections



The existing King Road underpass structure on the Highway 403 mainline is proposed to be replaced as part of this study. Following discussion with the City of Burlington, it was agreed that the structure will be replaced on the current roadway alignment to minimize property impacts. To undertake demolition of the existing structure and construction of the new underpass, King Road will need be closed for the duration of construction. MTO and the City agreed that alternative designs and staging strategies would be further considered during Detail Design to assess whether the Highway 403/King

Road underpass can be replaced without a full closure of King Road, and if no other reasonable options are feasible, the City would support the King Road closure for the duration required. The structural replacement will require an elevation raise of the roadway (as the new structure will be higher than the existing), and so a Hydro One access and commercial property accesses south of Highway 403 will require regrading to match the improvements however are not anticipated to require closures.

7.11.2.3 *FREEMAN INTERCHANGE INTERIM IMPROVEMENTS STAGING*

A benefit of the new Highway 403 eastbound to QEW eastbound ramp is that it is mostly constructed off-line to the existing ramp and is a complete replacement of the ramp. This means traffic can be accommodated on the existing ramp during construction and then shifted over to the new ramp once it is constructed. Therefore, no significant traffic impacts are anticipated because of this improvement. Minimal impacts / overnight lane closures may be required during the shifting of traffic from the existing ramp to the new construction.

In the same vein, a benefit of the QEW northbound to Highway 403 westbound ramp realignment is that it is mostly off-line from the existing. Traffic can be maintained on the existing infrastructure during construction and then shifted onto the improvements with minimal impacts / overnight lane closures. No significant traffic impacts are anticipated. The improvements that will enable three lanes of traffic from QEW westbound to Highway 403 westbound will be completed as part of the QEW mainline interim improvements staging.

7.11.2.4 *ARTERIAL ROAD INTERCHANGES INTERIM IMPROVEMENTS STAGING*

At the Brant Street and Guelph Line interchanges, off-ramp improvements will likely require ramp lane reductions and/or overnight closures to complete construction; however, the magnitude of construction required is relatively small in comparison to the other improvements of this phase.

To accommodate the QEW widening, the Plains Road East / Fairview Street interchange east ramp terminal will be relocated easterly and the northbound on-ramps realigned. While construction can occur off-line for the ramps, the improvements are tied with QEW widening and thus will factor into its stages. For the realigned northbound inner-loop ramp, a new structure is proposed over Fairview Street and its construction (specifically girder/box hoisting) will require overnight closure of the lanes on the arterial road. Traffic disruption and/or temporary lane closures can be anticipated with the relocation of the ramp intersection and new structure construction.

7.11.3 ULTIMATE IMPROVEMENTS STAGING

The ultimate improvements construction staging is largely simplified by the magnitude of construction that will occur in the interim phase. For the Highway 403, no further improvements are required (in addition to those completed in the interim). For the QEW, the median/HOV improvements constructed in the interim will be retained and the freeway is widened to outside by one general-purpose lane in each direction. The widening of the QEW will result in structural widening and/or new structures along the corridor, however will not require wholesale changes to the configuration of the QEW nor its interchanges. To complete the freeway widening, it is anticipated that lanes will be shifted inside towards the median to afford work-zones on the outside. Once construction is complete, lanes are shifted back to their original alignments and the additional general-purpose lanes are opened to traffic.

At the Freeman Interchange, the construction of the ultimate improvements will require temporary ramp closures of the 407 ETR to Fairview Street off-ramp and the Highway 403 to Fairview Street off-ramp. The ramp closures will be required to facilitate the construction of structural improvements and are anticipated to be needed for a duration of one or two construction seasons. Traffic exiting the freeway network will either exit earlier at Waterdown Road Interchange (if heading westbound on Highway 403) or exit later at North Shore Boulevard Interchange (if heading southbound on QEW from 407 ETR).

7.11.4 DEMOLITION/CONSTRUCTION OF STRUCTURES REQUIRING MAINLINE CLOSURE

As summarized in the previous sections, the construction staging strategy for each improvement phase has been developed with the objective of minimizing traffic impacts. However, it is acknowledged that overnight, full closures of the QEW mainline and QEW / Highway 403 ramps will be required at times to facilitate either the construction of new structures (e.g. girder/box hoisting) or the demolition of existing structures within the corridor.

These occurrences and their locations are summarized in **Table 7-4** for the interim phase and **Table 7-5** for the ultimate phase. No mainline closures are anticipated required for the for the immediate phase. Preliminary detours have been identified however these will be confirmed in Detail Design and closer to the time of occurrence. Based on experience of similar projects, the project team anticipates that the mainline closures could be confined to eight-hour windows overnight. Due to the travel patterns and traffic volumes in the study area, it is recommended the closures not occur on Friday nights (time of highest volume).

Table 7-4: Mainline Closures during Construction/Demolition - Interim Improvements

Structure / Works	Location	Anticipated Closures	Potential Detours
New Structure (Construction / Girder Hoisting)	Hwy 403 eastbound to QEW eastbound ramp over QEW	QEW Niagara- or Toronto-bound Lanes: depending on span hoisted	Heading Niagara-bound, traffic can detour using mainline to municipal road network using Guelph Interchange to Fairview Street and then back onto QEW at the Plains Road East / Fairview Street IC.
Existing structure (Site #10-333) / Demolition		All QEW Niagara- and Toronto-bound Lanes	
New Structure (Construction / Girder Hoisting)	Hwy 403 eastbound to QEW eastbound ramp over 407 ETR to QEW southbound / Fairview Street off-ramp.	All 407 ETR to QEW southbound ramp lanes	Heading southbound, traffic will likely detour via Highway403 to exit at Waterdown Road. Traffic will need to turn around at Waterdown Road to take Highway 403 Eastbound ramp and then head to QEW Niagara.
Existing structure (Site #10-332) / Demolition			
New Structure (Construction / Girder Hoisting)	QEW westbound to Highway 403 westbound ramp 407 ETR to QEW southbound / Fairview Street off-ramp		
New Structure (Construction / Girder Hoisting)	Highway 403 at King Road	West- or Eastbound Highway 403: depending on span hoisted	Heading westbound, traffic will likely detour via North Service Road to Waterdown Road interchange. Eastbound will likely detour from Waterdown Road interchange, via local road network to Guelph Line.
Existing structure (Site #10-195) / Demolition		All Highway 403 lanes	

Table 7-5: Mainline Closures during Construction/Demolition - Ultimate Improvements

Structure / Works	Location	Anticipated Closures	Potential Detours
New Structures (Construction / Girder Hoisting)	QEW northbound to 407 ETR northbound over QEW	QEW Niagara- or Toronto-bound Lanes: depending on span hoisted	Heading Niagara-bound, traffic can use Guelph Interchange to Fairview Street and then back onto QEW at the Plains Road East / Fairview Street IC.
Existing structure (Site #10-320) / Demolition	QEW northbound to Highway 403 westbound over QEW	All QEW Niagara- and Toronto-bound Lanes	
New Structures (Construction / Girder Hoisting)		QEW Niagara- or Toronto-bound Lanes: depending on span hoisted	
New Structures (Construction / Girder Hoisting)	QEW northbound to 407 ETR northbound to over QEW westbound to Highway 403 westbound	All QEW westbound to Highway 403 westbound lanes.	Heading westbound, traffic can detour from Brant Street interchange via North Service Road to Waterdown Road interchange.
Existing structure (Site #10-321) / Demolition	QEW northbound to Highway 403 westbound over QEW westbound to Highway 403 westbound		
New Structures (Construction / Girder Hoisting)			

7.11.5 CONSTRUCTION STAGING DURATION ESTIMATES

Table 7-6 summarizes the construction duration estimates anticipated required for the Interim Improvements phase. The construction staging plan and details, including confirmation of closures and construction durations, will be confirmed in Detail Design. Overall, the construction will take at least three and a half construction seasons, assuming the QEW improvements are constructed concurrently under one contract. If the QEW improvements are split into multiple contracts, the construction duration could be longer.

For the ultimate improvements, it is more difficult to predict construction durations at this stage as the entirety of work required is unknown. The ultimate improvements identified by this study largely result in structural needs (new construction and/or widening, and demolition of redundant existing structures) and this would take at least two construction seasons to complete. However, by the time of the improvements, other work may also be required due to service life needs of the surrounding infrastructure. This could include, but is not limited to: pavement re-construction, noise-wall reconstruction, and the potential rehabilitation of structures not impacted by the ultimate improvements. The scope of works for these items will be identified closer to their time of need and will be identified through detailed condition surveys.

Table 7-6: Interim Improvements Preliminary Construction Staging Duration Estimates

Stage / Summary of Works	Estimated Construction Duration (Weeks)	Construction Seasons (Years)
Stage 2A: Offline widening and structural work.	36 Weeks	~1 ½
Stage 2B: Traffic shifted to new construction, localized work.	12 Weeks	~ ½
Stage 2C: Construction in mainline median.	30 Weeks	~ 1 ½
Stage 2D: Open improved highway to traffic.	Overnight	N/A
Total Duration	78 Weeks	~ 3 ½